नेपाल सरकार

कृषि तथा पशुपन्छी विकास मन्त्रालय

प्रधानमन्त्री कृषि आधुनिकीकरण परियोजना

परियोजना व्यवस्थापन एकाइ

खुमलटार, ललितपुर

आर्थिक वर्ष २०८१/८२

Status & Effectiveness of Cold Rooms/Cold Chambers Established Under PMAMP

Government of Nepal

Ministry of Agriculture and Livestock Development

Prime Minister Agriculture Modernization Project

Project Management Unit

Khumaltar, Lalitpur

FY 2081/82

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Publisher:
Prime Minister Agriculture Modernization Project
Project Management Unit
Khumaltar, Lalitpur

Published Year:
2082(2025)

Layout:
Dr Er Jeet B Chand, PMAMP, PMU
Er Sameer Shrestha, PMAMP, PMU

Printing Press:
3D Printers & Publishers
Gatthaghar, Bhaktapur

मन्तव्य

आन्तरिक संस्थागत जनशक्तिबाट दस्तावेज तयार भई नेपाल सरकारको आफ्नै स्रोतबाट सञ्चालन हुने गरी "कृषि विकास रणनीति" कार्यान्वयनको सहयोगी परियोजनाको रुपमा कृषिमा आधारित अर्थतन्त्रबाट कृषिजन्य उद्योगमा रुपान्तरित आधुनिक, व्यावसायिक, दिगो एवम आत्मनिर्भर कृषि क्षेत्रको विकास गर्ने सोचका साथ नेपाल सरकार, मन्त्रिपरिषद्को मिति २०७३/०९/२६ को निर्णयबाट आ.व. २०७३/०७४ देखि प्रधानमन्त्री कृषि आधुनिकीकरण परियोजना १० वर्षको लागि नेपालका सातै प्रदेश, ७७ जिल्ला र ७५३ पालिकाहरुमा सञ्चालनमा रहेको छ। कृषि उत्पादन र उत्पादकत्व वृद्धिका लागि आवश्यक प्रविधि, पहुँच तथा उत्पादन सामाग्रीको व्यवस्था, बाली/वस्तुको उत्पादन लागत घटाउनको लागि यान्त्रिकरण एवम् पूर्वाधार विकास लगायतका क्रियाकलापमार्फत प्रशोधन तथा बजारीकरण गरी उत्पादनको मूल्य अभिवृद्धि गर्ने स्पष्ट मार्गचित्रका साथ नेपालको कृषि क्षेत्रको आधुनिकीकरणको परिकल्पना यस परियोजनामा गरिएको छ। कृषि क्षेत्रको समग्र विकासका लागि सरोकारवाला समुदायकै नेतृत्वले सहजीकरण गरी आधुनिकीकरणको प्रक्रियालाई तीव्र गति दिने सोचाई राखिएको यस परियोजनामा मुख्यतः चारवटा सम्भागहरुः साना व्यवसायिक कृषि उत्पादन केन्द्र (पकेट) विकास कार्यक्रम, व्यवसायिक कृषि उत्पादन केन्द्र(ब्लक) विकास कार्यक्रम,व्यवसायिक कृषि उत्पादन तथा प्रशोधन केन्द्र (जोन) विकास कार्यक्रम र वृहत व्यवसायिक कृषि उत्पादन तथा औद्योगिक केन्द्र (सुपरजोन) विकास कार्यक्रमको व्यवस्था गरी उत्पादन,प्रशोधन तथा औद्योगिकीकरणमार्फत कृषिमा आत्मनिर्भरताको दिशामा अगाडी बढ्ने अपेक्षा गरिएको छ। परियोजनाको दस्तावेजमा उल्लेख गरिएको अपेक्षित उपलब्धीहरुको हालसम्मको प्रगतिको अवस्था हेर्दा आ.व.२०७३/०७४ देखि देशभर ७७ जिल्लामा विशिष्टीकृत बाली वस्तुहरुमा पकेट, ब्लक, जोन र सुपरजोन स्थापना भई कार्यक्रम सञ्चालन भइरहेका छन्।

नेपालको कृषि विकासमा अथाह सम्भावना हुँदा पनि कृषकहरुले अपेक्षित लाभ लिन नसकेको कुरा सर्वविदितै छ। यसको पछाडी विविध कारणहरु छन् जसमध्ये उपयुक्त, नयाँ र प्रमाणित प्रविधीहरु कृषकस्तरमा पुऱ्याउन नसक्नु पनि एक हो। नेपाली कृषिको उत्पादकत्व कम हुनुको एउटा कारण कृषिमा आधुनिक भण्डारण प्रविधिको कम प्रयोग हो। नेपालमा कोल्ड रुम निर्माणको प्रचुर सम्भावना छ र हामीले हाम्रो कृषिलाई जलवायु-स्मार्ट बनाउन त्यसलाई प्रवर्द्धन गरिरहेका छौं। परियोजनाले हालसम्म विभिन्न जिल्लाहरुमा करिब ९० बटा कोल्डरुम निर्माणमा आर्थिक तथा प्राविधिक सहयोग गरिआएको छ। तसर्थ कोल्ड रुम निर्माण तथा यस्को अवस्था तथा प्रभावकारितासँग सम्बन्धित विभिन्न विषय/पक्षहरु समेटेर तयार गरिएको यो पुस्तक महत्वपूर्ण छ। यस पुस्तकलाई साकार रुप दिन प्रत्यक्ष संलग्न हुनुभएका पूर्वाधार विकास शाखाको वरिष्ठ इन्जिनियर डा. जीत ब. चन्द र कृषि इन्जिनियर समीर श्रेष्ठलाई विशेष आभार व्यक्त गर्दछु। यसैगरी पुस्तक छपाईको कार्यभार पुरा गर्ने थ्रीडी प्रिन्टर तथा कृषि विकासका क्षेत्रमा योगदान गर्नुहुने सबैलाई हार्दिक धन्यवाद प्रकट गर्दछु।

हिक्मत कुमार श्रेष्ठ
परियोजना निर्देशक

Study Team

Dr Jeet B Chand
Senior Agricultural Engineer
NEC No.: 83 "A"
PMAMP, PMU
Khumaltar, Lalitpur

Er Sameer Shrestha
Agricultural Engineer
NEC No.: 249 "A"
PMAMP, PMU
Khumaltar, Lalitpur

Executive Summary

A cold room and a cold chamber are essentially the same thing: a controlled environment designed to store items at a specific temperature and humidity. They are used to preserve temperature-sensitive materials like agricultural commodities, pharmaceuticals, biological samples, and more. The principle of a cold chamber revolves around thermodynamics, the science of heat transfer, and energy conversion. Cold chambers are designed to remove heat from an enclosed space and maintain a lower temperature than the surrounding environment. Cold chambers are essential for the agricultural and food industry, allowing the safe storage and transportation of perishable goods like meat, dairy products, fruits, and vegetables. By slowing down microbial growth and enzymatic activity, cold storage significantly extends the shelf life of these products, reducing food waste and ensuring consumer safety. The major components of cold room/ cold chamber include: Refrigeration System, insulation, air circulation system, temperature/ humidity control and monitoring system. In essence, a cold chamber functions as a self-contained ecosystem, where these key components work in harmony to remove heat, maintain a stable low-temperature environment, and ensure the preservation of stored products or the success of scientific experiments. Cold chambers are also used for chilling and freezing food products to specific temperatures, which is crucial for ensuring food safety and preventing the growth of harmful bacteria. They also play a role in quality control, ensuring that food products maintain their desired texture, flavour, and nutritional value.

According to reports issued by UN-FAO, about one-third of the world's food is lost each year, worth US$ 8.3 billion. Fruits and vegetables account for 40% to 50% of food losses globally. With increasing emphasis on the food cold chain, fruits and vegetables have become the main research objects. Fruit and vegetable cold chain logistics refers to a supply chain system that keeps products under suitable temperature conditions from the beginning of picking, processing, storage, transportation, and sales to consumers, to ensure product quality and safety and reduce losses. Fruits and vegetables have the characteristics of perishability, temperature sensitivity, and cross-regional transportation, which makes their transportation and distribution technical requirements higher. Traditional mechanical refrigeration is prone to temperature fluctuation and high carbon emission during transportation. With the country's emphasis on energy conservation and the development of cold chain logistics, cold storage technology has attracted widespread attention. The maximum amount of food losses in the fruits and vegetable supply chain due to quality and mismatch between supply and demand. Fruits and vegetables food losses due to improper handling and lack of proper cold transportation such as cold-logistics facilities/providers or inadequate infrastructure.

Agriculture plays a vital role in the economy of Nepal, contributing significantly to employment and livelihoods. Despite the progress in crop production and productivity, post-harvest losses remain a major bottleneck in ensuring food security, increasing farmer income, and promoting agricultural commercialization. One of the major reasons for these losses is the lack of proper storage and preservation infrastructure, especially for perishable commodities like fruits, vegetables, dairy products, and seeds. To address this critical gap in the agricultural value chain, the Government of Nepal, under the Prime Minister Agriculture Modernization Project (PMAMP), initiated the construction of cold rooms and cold chambers across various regions of the country. These facilities aim to reduce post-harvest losses, improve market timing and prices for producers, and contribute to the overall resilience and modernization of Nepal's agriculture sector.

A total of 87 cold rooms have been constructed under PMAMP from Fiscal Year 2072/73 to FY 2080/81, spanning all seven provinces. While these investments have been significant, there is a need to systematically assess:

- Their current operational status and geographical distribution,
- Effectiveness in terms of commodity storage and reduction of losses,
- Their contribution to farmer welfare, market access, and sustainability.
- Measure their economic, social, and environmental impacts,
- Identify gaps and challenges in their usage and sustainability, and
- Recommend policy and operational improvements for future interventions.

This study is designed to evaluate these aspects and guide future cold chain interventions under PMAMP and similar projects. The main objective of this study is to assess the status and effectiveness of cold rooms and cold chambers constructed under PMAMP. Specific objectives include:

- To map and verify the cold rooms installed across provinces and agro-ecological zones (mountain, hill, terai).
- To assess their operational status and utilization by farmers and cooperatives.
- To analyze their impact on crop preservation, value chain enhancement, and market access.
- To identify technical, managerial, and financial challenges.
- To provide recommendations for improving future cold storage projects and ensuring sustainability.

  The study covered 25 cold rooms selected from a total of 87 installed units across diverse geographical and ecological zones, with data collected through field engineer visits and Focus Group Discussions (FGDs) conducted by the PMU team in five districts. The assessment combined: Direct field visits and FGDs (Focus Group Discussions) conducted by the PMU Engineering Team; and Structured questionnaire-based surveys carried out by implementation unit engineers. The findings are presented in both geographical (province and topography) and commodity-wise formats to better reflect the practical impacts of the cold room projects. The sampling considered geographical diversity, covering different provinces and ecological zones including the Mountain, Hill, and Terai regions. Additionally, the selection reflected the range of commodities stored in the cold rooms; such as vegetables, fruits, dairy products, and seeds, ensuring commodity-wise inclusiveness. The study also accounted for variations in operational models, incorporating cold rooms managed by community groups, cooperatives, and private entities to provide a comprehensive understanding of their status and effectiveness.

Quantitative data collected from structured questionnaires were compiled and analyzed using Microsoft Excel and basic statistical tools to assess the utilization rates, operational status, and regional variations among the surveyed cold rooms/ cold chambers. Metrics such as storage occupancy, frequency of use, seasonal trends, and commodity types were compared across ecological zones (Mountain, Hill, Terai) and provinces. The analysis also included evaluation of the cold rooms' physical condition, availability of backup power systems, and maintenance practices. These insights were used to measure the effectiveness of cold rooms in preserving perishable agricultural products and supporting post-harvest management. Furthermore, the findings contributed to evaluating the cold rooms' alignment with PMAMP's goal of enhancing agricultural productivity through improved storage infrastructure, particularly in relation to reducing post-harvest losses and maintaining commodity quality.

Qualitative data obtained from Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were analyzed thematically to capture user perspectives, local knowledge, and social dynamics related to cold room use. This analysis focused on identifying success stories, key challenges in management and access, the extent of community participation, gender roles in operation and decision-making, and perceived economic benefits. These narratives offered a deeper understanding of the social dimensions of cold room effectiveness, including inclusivity, affordability, and sustainability of the interventions. Additionally, GIS analysis was used to assess spatial patterns and coverage gaps, helping visualize the accessibility of cold storage infrastructure in relation to major production belts and underserved regions. The integration of qualitative, quantitative, and spatial data enabled triangulation of findings and ensured a comprehensive analysis aligned with the study's objectives.

The cost analysis of cold storage facilities shows a wide range of initial setup expenses, with cold room costs generally constituting the largest portion. Initial setup costs vary from approximately NPR. 5 lakhs to over 30 lakhs, reflecting differences in facility size, technology, and location. Cold room construction costs closely align with initial setup expenses, typically ranging between 5 lakhs and 18 lakhs. Shed costs, when applicable, are significantly lower, mostly between 10,000 and 4.5 lakhs, with some facilities reporting no shed costs at all. The variability in shed costs depends on materials used, such as CGI sheets, and the scale of the structure. Overall, the data highlights that cold room investment is the major financial component, while shed costs are relatively minor but necessary for protection and operational efficiency. This cost breakdown aids stakeholders in budgeting and planning cold storage infrastructure development.

The data on cold storage operations reveals diverse operating months, cost structures, and profitability across facilities. Operating periods range from 2 months to year-round, often aligned with seasonal crop cycles. Average monthly operating costs vary widely, from as low as NPR 1,000 to over NPR 20,000, with maintenance costs frequently unreported or inconsistent. Energy costs typically range between NPR 1,600 and NPR 7,500 monthly. Monthly revenue generation fluctuates significantly, from negligible amounts to over Rs 2 lakh, with profit margins reported between 0% and 60%, depending on operational efficiency and scale. Some facilities operate primarily for own use with no profit, while others show healthy margins around 30-50%. Several units have yet to estimate profit margins or document costs fully. Overall, the data highlights the variability in cold storage economics, influenced by seasonality, scale, and management practices, underscoring the need for better cost tracking and financial planning.

The evaluation of product quality before and after cold storage reveals several recurring issues such as weight loss, early ripening, spoilage, and softening of fruits like kiwi, orange, and apple. Common problems include temperature fluctuations, electricity load shedding, irregular maintenance, and equipment malfunctions, particularly with humidifiers and air conditioning systems. Solutions suggested range from improved post-harvest handling, consistent temperature and humidity control, backup generators, to technical training and better maintenance practices. Manufacturer responses vary widely from good and timely support to poor or no response, with some manufacturers not responding to calls or providing delayed services. Facilities with proper maintenance and technical knowledge report better quality retention.

Users emphasize the urgent need for larger cold chambers instead of small cool booths to accommodate higher production volumes. Adequate and continuous training on cold room operation, maintenance, and product handling is critical to improve efficiency and reduce technical issues. Many suggest better guidance from manufacturers and local authorities, along with regular monitoring by technicians. Reliable electricity supply and backup generators are essential to ensure uninterrupted operation. Improving infrastructure through budget allocation for high-capacity storage, quality assurance by responsible companies, and availability of local repair dealers is also recommended. Users call for enhanced transportation facilities to reduce post-harvest losses and better crate or rack systems for handling. Additionally, research on crop-specific storage, subsidized energy costs, and shifting towards mechanized processing are suggested to boost cold storage effectiveness and reduce product wastage. Overall, training, infrastructure, and technical support from the cornerstone for improving cold storage operations.

The construction of cold rooms under the Prime Minister Agriculture Modernization Project (PMAMP) has played a significant role in reducing post-harvest losses and improving the preservation and marketability of perishable agricultural products across diverse agro-ecological zones in Nepal. The study reveals that cold rooms have contributed to better price realization for farmers, improved storage duration, and enhanced resilience of local agricultural value chains. However, several challenges persist, including underutilization in some areas, technical and operational issues, inadequate staff training, limited waste management practices, and inconsistent maintenance. The lack of reliable electricity supply, insufficient pre-cooling infrastructure, and gaps in coordination between operators and technical staff further hinder optimal performance. Despite these challenges, user feedback is generally positive, and the demand for cold storage facilities remains high, underscoring their importance for Nepal's agricultural modernization and food security.

A major limitation of cold rooms and chambers found in the study is the potential for oxygen depletion and asphyxiation due to low air exchange rates, especially when storing dry ice or other materials that can displace oxygen. Another limitation was the risk of mold growth if proper ventilation and hygiene are not maintained, which can lead to contamination of stored items and health problems. The low temperatures and moisture in cold rooms can create an ideal environment for mold growth. Improper storage practices, such as storing items directly on the floor or using cardboard, can contribute to mold contamination. In addition, cold rooms are often sealed, and the slow circulation of air can lead to a buildup of carbon dioxide and a decrease in oxygen levels, and can be particularly dangerous if dry ice is stored.

Cold rooms (also known as cold chambers or cold storage) are crucial for preserving perishable goods and maintaining the integrity of temperature-sensitive materials. They provide a controlled environment, preventing spoilage, extending shelf life, and ensuring the safety and efficacy of stored products. This study recommends: a) Provide regular training and capacity-building programs for cold room operators and technical staff, b) Invest in essential infrastructure, including pre-cooling chambers, reliable electricity (with backup options), and modern harvesting tools; c) Promote digital monitoring systems for real-time control of temperature and humidity, d) Strengthen coordination between cold room operators, local governments, and technical experts for better maintenance and troubleshooting; e) Encourage community or cooperative management models for sustainable and equitable facility use, f) Review and streamline subsidy and policy mechanisms to prevent duplication and ensure fair access, and g) Conduct feasibility studies before establishing new cold storage facilities and prioritize expansion in underserved regions.

Acknowledgements

This formal acknowledgement may not express depth of feelings and emotion towards the persons and institutions who contributed this study. At first, we would like to express our profound gratitude & sincere appreciation to former project director, PMAMP- Baikuntha Adhikari and current project director Hikmat Kumar Shrestha, who have been very kind and supportive throughout this study period. Expert group's valuable suggestions and free exchange of ideas facilitated us to deepen the selected subject matter of the study. Presence and assistance of all these valued people made the journey of this study important, exciting, and novel in the history of Nepal's agriculture sector, particularly linking multifaceted use of cold chain management in agriculture sector.

Similarly, we would like to use this opportunity to express our heartiest respect and acknowledgement to PMAMP agricultural engineering team: Er Bigyan Acharya, Er Anish Shrestha, Er Dol Prasad Sharma, Er Chhabi Dangi Chhetri, Er Manish Thakur, Er Sushil Budha, Er Netra Bohara, Er Nagendra Tharu and Dilip Karki; whose constant selfless support helped us from very beginning to end of this study. We are also thankful to all the staffs at PMAMP-PMU for supporting activities and finance. Equal gratitude goes to PIUs: Ramechhap, Sarlahi, Dolakha, Sindhuli, Morang, Sarlahi, Dhankuta, Nuwakot, Chitwan, Kapilbastu, Bardia, Rupendehi, Kaski, Okhaldhunga and Ialm for contribution in selecting representative cold rooms/cold chambers for study purpose.

Last but not the least, we are also indebted to the printing press for quality publication on time.

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1 Introduction

1.1 Background

With the country's emphasis on energy conservation and the development of cold chain logistics, cold storage technology has attracted widespread attention (Qi et al. 2022). The maximum amount of food losses in the fruits and vegetable supply chain due to quality and mismatch between supply and demand (Raut et al. 2019). Fruits and vegetables food losses due to improper handling and lack of proper cold transportation such as cold-logistics facilities/providers or inadequate infrastructure. As per the Global Agenda Council on Logistics and Supply Chains indicated that fruits and vegetables food losses due to improper handling and lack of proper cold transportation such as cold-logistics facilities or inadequate infrastructure (www.weforum.org). Singh et al. (2017) presented that in the Asian developing nations such as India, an estimated 20–30 percent fruits and vegetable food losses due to lack of cold logistics infrastructure available. The fruits and vegetable food losses reduction is possible by improving the efficiency of cold supply chain management (CSCM) that are correctly used to maintain perishable/ fruits and vegetable food in the controlled temperature range is monitored to as the cold-logistics.

According to Qi et al. (2022), "Fruits and vegetables have the characteristics of perishability, temperature sensitivity, and cross-regional transportation, which makes their transportation and distribution technical requirements higher. Traditional mechanical refrigeration is prone to temperature fluctuation and high carbon emission during transportation. Therefore, PCMs has great application potential in the cold chain transportation of fruits and vegetables, and its application will help improve food safety and save energy. This paper analyzes the characteristics of fruit and vegetable cold chain logistics, and introduces the composition of the cold storage box, summarizes the application and research of phase change cold storage technology in cold chain transportation. A summary analysis including the refrigeration, temperature control, heat insulation, and energy-saving effects of PCMs, points out the research prospects of transportation equipment and problems that need to be solved, and provides a reference for building a more complete and efficient cold chain transportation system for fruits and vegetables in the future. According to a survey in 2018, the global cold chain logistics market has reached 160 billion U.S. dollars and is expected to increase to 585 billion U.S. dollars by 2026. According to reports issued by Food and Agriculture Organization of the United Nations and National Development Council, about one-third of the world's food is lost each year, worth US$8.3 billion. Fruits and vegetables account for 40 % to 50 % of food losses globally. With increasing emphasis on the food cold chain, fruits and vegetables have become the main research objects. Fruit and vegetable cold chain logistics refers to a supply chain system that keeps products under suitable temperature conditions from the beginning of picking, processing, storage, transportation, and sales to consumers, to ensure product quality and safety and reduce losses. ”

Cold chain management is the process of storing and transporting temperature-sensitive products, like pharmaceuticals and food, while maintaining their quality and safety by controlling temperature throughout the supply chain. The cold chain is a critical subset of the supply chain focusing on transporting and storing perishable products like frozen food or vaccines at their optimal temperatures. Cold chain management refers to the systematic oversight of these temperature-sensitive goods to maintain their quality and integrity. Cold chain management focuses on the entire process, from production to the end consumer, ensuring that temperature-sensitive goods remain within their required temperature range. Cold Chain Management (CCM) is an integrated service offering both the physical aspects, such as transportation or storage, and digital capabilities that enable true end-to-end supply chain management.

Cold chain management is important to maintaining the correct temperature is crucial for preserving the quality, safety, and efficacy of products like vaccines, medications, and perishable foods.

What it involves:

a. **Storage:** Using refrigerated facilities and equipment to maintain the required temperature.
b. **Packaging:** Employing appropriate packaging to protect products during transport and storage.
c. **Transportation:** Using refrigerated vehicles and equipment to transport products safely.
d. **Monitoring:** Tracking temperature throughout the supply chain using temperature monitoring devices.
e. **Training:** Ensuring that all personnel involved in the cold chain are properly trained in handling and maintaining temperature-sensitive products.

Benefits of effective cold chain management:

a. Improved product quality and safety: Maintaining the required temperature ensures that products remain safe and effective.
b. Reduced waste and spoilage: Proper temperature control minimizes the risk of spoilage and waste.
c. Increased efficiency and cost savings: By reducing waste and improving logistics, cold chain management can lead to cost savings.

d. **Enhanced customer satisfaction:** Ensuring that products are delivered in good condition can lead to increased customer satisfaction and loyalty.
e. **Compliance with regulations:** In industries like pharmaceuticals, cold chain management is a regulatory requirement.

1.2 PMAMP and cold chain initiatives

Agriculture plays a vital role in the economy of Nepal, contributing significantly to employment and livelihoods. Despite the progress in crop production and productivity, post-harvest losses remain a major bottleneck in ensuring food security, increasing farmer income, and promoting agricultural commercialization. One of the major reasons for these losses is the lack of proper storage and preservation infrastructure, especially for perishable commodities like fruits, vegetables, dairy products, and seeds.

To address this critical gap in the agricultural value chain, the Government of Nepal, under the **Prime Minister Agriculture Modernization Project (PMAMP)**, initiated the construction of cold rooms and cold chambers across various regions of the country. These facilities aim to reduce post-harvest losses, improve market timing and prices for producers, and contribute to the overall resilience and modernization of Nepal's agriculture sector.

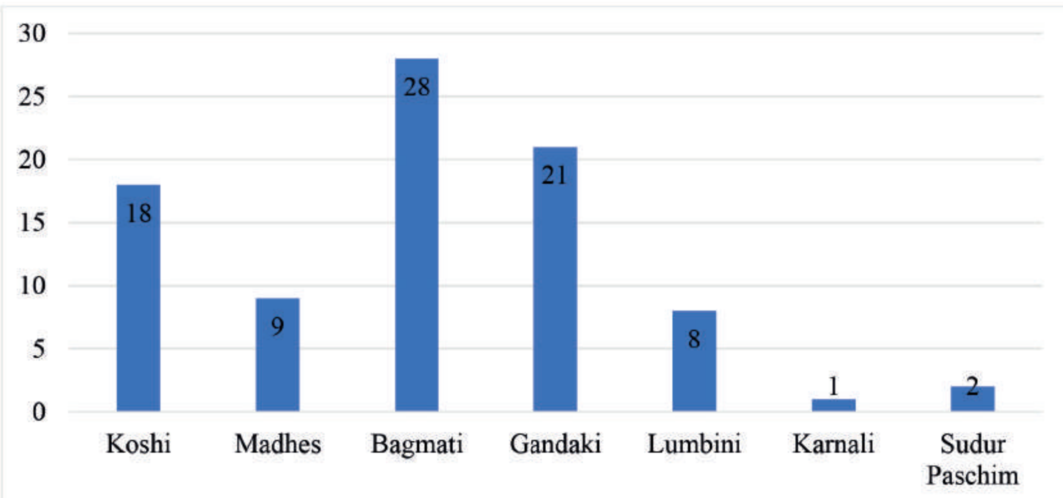


Fig 1.1 Cold room/ Cold chamber constructed under PMAMP from FY 2072/73 to FY 2079/80

1.3 Rationale of the Study

A total of 87 cold rooms have been constructed under PMAMP from Fiscal Year 2072/73 to FY 2079/80, spanning all seven provinces. While these investments have been significant, there is a need to systematically assess:

- Their current operational status and geographical distribution,
- Effectiveness in terms of commodity storage and reduction of losses,
- Their contribution to farmer welfare, market access, and sustainability.
- Measure their economic, social, and environmental impacts,
- Identify gaps and challenges in their usage and sustainability, and
- Recommend policy and operational improvements for future interventions.

This study is designed to evaluate these aspects and guide future cold chain interventions under PMAMP and similar projects.

1.4 Objectives of the Study

The main objective of this study is to assess the status and effectiveness of cold rooms and cold chambers constructed under PMAMP. Specific objectives include:

- To map and verify the cold rooms installed across provinces and agro-ecological zones (mountain, hill, terai).
- To assess their operational status and utilization by farmers and cooperatives.
- To analyze their impact on crop preservation, value chain enhancement, and market access.
- To identify technical, managerial, and financial challenges.
- To provide recommendations for improving future cold storage projects and ensuring sustainability.

1.5 Scope of the Study

The study covers 25 cold rooms selected from a total of 87 installed units across diverse geographical and ecological zones, with data collected through field engineer visits and Focus Group Discussions (FGDs) conducted by the PMU team in five districts.

Table 1.1 Selected cold rooms for data collected through field engineer

Province	Total Cold Rooms Installed	Cold Rooms Surveyed	Mountain	Hill	Terai
Koshi	18	7	5	2	-
Madhes	9	0	-	-	-
Bagmati	28	9	-	9	-
Gandaki	21	5	4	-	1
Lumbini	8	2	-		2
Karnali	1	-	-	-	-
Sudur Paschim	2	2	-	2	-
Total	**87**	**25**	**9**	**13**	**3**

The assessment combines:

- **Direct field visits and FGDs** (Focus Group Discussions) conducted by the **PMU Engineering Team**.
- **Structured questionnaire-based surveys** carried out by implementation unit engineers.

The findings are presented in both **geographical** (province and topography) and **commodity-wise** formats to better reflect the practical impacts of the cold room projects.

1.6 Limitations

- The study covers **only 25 of the 87** cold rooms due to time and resource limitations.
- Some of the data collected through questionnaires may be subject to self-reporting bias.
- Operational and financial records at several sites were not digitized, affecting data uniformity.
- Findings from a sample size may not fully capture conditions in all provinces, though efforts were made to ensure geographical representation.
- Seasonal variation in cold room use could not be fully observed in a single survey period.

Despite these limitations, triangulation through FGDs, engineering assessments, and cross-checking with local records was done to ensure data validity and representativeness.

2

Literature Review

नेपालको राष्ट्रिय अर्थतन्त्रमा कृषि क्षेत्रले ठुलो योगदान पुऱ्याउदै आएको छ तर परम्परागत खेती प्रणाली, उपयुक्त पुर्वाधार, प्रविधि एंव जनशक्तिको अभाव जस्ता कारणहरुले गर्दा नेपालको कृषि क्षेत्रले अपेक्षित गति लिन सकेको छैन। भौगोलिक परिवेशले उपलब्ध गराएका अवसरहरु, प्रयोगशालामा प्रमाणित प्रविधिहरु तथा श्रोत साधनहरुलाई एकीकृतरुपमा संयोजन गरी लागु गर्न सकेको खण्डमा नेपालको कृषिले युगान्तकारी परिवर्तन गर्ने प्रशस्त सम्भावना बोकेको छ।

देशको भौगोलिक परिवेश, उपलब्ध कृषि शिक्षा, अनुसन्धान, उन्नत वीउ विजन र प्रविधि, श्रोतसाधन, कृषि उद्यमी युवा तथा सिमान्त कृषक वर्गको चाहना, तुलनात्मक लाभ र राष्ट्रिय आवश्यकता तथा नेपालले अन्तराष्ट्रिय स्तरमा गरेका सन्धि, सम्झौता, प्रतिवद्धता, दीगो विकास लक्ष्य २०३०, राष्ट्रिय नीतिहरुमा गरेका प्रतिवद्धतालाई मध्यनजर राख्दै कृषिजन्य उत्पादन एवं व्यापारमा प्रतिस्पर्धा, व्यवसायिकरण, यान्त्रिकरण, विविधिकरणमा जोड दिनुका साथै आर्थिक तथा सामाजिक रुपमा पछि परेका वर्गहरुलाई समेत प्राथमिकता दिई सरकारी, सहकारी, नीजि साझेदारीको अवधारणा अंगिकार गर्दै कृषि पेशालाई सम्मानजनक बनाई आय तथा रोजगारी सिर्जना, गरिबी न्यूनीकरण, सुधारात्मक व्यापार सन्तुलन, दिगो र सन्तुलित विकास, खाद्य तथा पोषण सुरक्षा र कृषि क्षेत्रको रुपान्तरण मार्फत आर्थिक रुपान्तरण गर्दैराष्ट्रिय अर्थतन्त्रलाई बलियो बनाउनु आजको प्रमुख आवश्यकता रहेको छ।

सम्भावना र चुनौतीहरुलाई मध्यनजर गर्दै नेपाल सरकारले कृषि क्षेत्रको दिर्घकालिन सोच सहित २० वर्षे कृषि विकास रणनीति तर्जुमा गरी कार्यान्वयनमा ल्याएको छ। कृषि विकास रणनीतिको सहयोगी परियोजनाको रुपमा रहेको प्रधानमन्त्री कृषि आधुनिकीकरण परियोजनाले कृषिमा आधारित अर्थतन्त्रलाई यान्त्रीकरण, विशिष्टीकरण तथा आधुनिकीकरण गरि कृषिजन्य उद्योगमा रुपान्तरण गर्दै व्यवसायिक, दिगो एवं आत्मनिर्भर कृषि क्षेत्रको विकास गर्ने सोच लिएको र उक्त सोचलाई मुर्तरुप दिन कृषि उपादनको विशिष्टीकृत क्षेत्र निर्माण, निर्यातयोग्त कृषि वस्तुहरुको मुल्य अभिवृद्धि तथा प्रतिस्पर्धात्मक क्षमता वृद्धि र सम्बन्धित सबै सरोकारवालाहरुसँगको कार्यमुलक समन्वयलाई प्राथमिकता दिने जस्ता उदेश्यहरु लिएको छ। स्वदेशी सोच, श्रोत तथा उपलब्ध जनशक्तिबाट तयार गरीएको यो परियोजना कार्यान्वयनमा सबै सरोकारवालाहरु जिम्मेवारीबोधका साथ संलग्न रहन सके कृषि क्षेत्रको विकासले तिव्रता पाउने छ।

२०७२ सालमा जारी भएको नेपालको संविधानले खाद्य सम्बन्धी हकलाई जनताको मौलिक हकका रुपमा स्थापित गरिसकेको साथै दिगो आत्मनिर्भर एव व्यवसायिक कृषि क्षेत्रको परिकल्पना सहित

कृषि विकासको २० बर्षे रणनीति (ADS) (२०१५-२०३५) कार्यान्वयनको क्रममा रहेको छ । विनासकारी भूकम्प र सो पश्चातको असहज पारवाहनबाट सिर्जित परिस्थितीका कारण खाद्यान्न उत्पादन र उपलब्धतामा थप असहजता आउनुका साथै बढ्दो आयात र घट्दो निर्यातले चुलिदै गएको व्यापार घाटाले कृषिमा आश्रित नेपालको सम्रग अर्थतन्त्र नै धरासायी बन्दै गईरहेको र देशको युवा शक्तिको बढ्दै गएको विदेश पलायनले श्रम शक्तिको अभाव र खेतीयोग्य कृषि भूमि बाँझो रहने क्रम बढिरहेको परिप्रेक्षमा जनताको आधारभूत आवश्यकताका रुपमा रहेको कृषि उपजहरुमा परनिर्भरताको अन्त्य गरि बढ्दो आयातलाई प्रतिस्थापन र निर्यातलाई प्रर्वद्धन गर्नका लागि नेपाल सरकारले जारी गरेको स्वेत-पत्र, कृषि विकासको २० बर्षे रणनीतिका साथै कृषि विकास मन्त्रालयका प्रतिवद्धताहरु २०७२ समेतलाई मध्यनजर राख्दै विभिन्न सरोकारवाला निकायहरुसंगको सहभागिता एवं पृष्ठपोषण सहित कृषिको व्यवसायिकरण मार्फत औद्योगिकिकरणमा रुपान्तरणका लागि भौगोलिक सम्भाव्यता र तुलनात्मक लाभका आधारमा छनौट गरिएका क्षेत्र र बालीहरुमा एकीकृत रुपमा सघन कृषि विकासका कार्यक्रमहरु सन्चालन गर्नु आजको प्रमुख आवश्यकता रहेको छ।

पछिल्लो समय नेपालको समग्र कृषि क्षेत्रमा केही आधुनिकिकरणका संकेत र परिदृश्यहरु देखिएका छन् उन्नत कृषि सामग्रीहरु तथा प्रविधिको प्रयोग, यान्त्रिकरण, बजारमा आधारित कृषि उपज उत्पादन तथा वितरण, कृषि फर्मको नाफा नोक्सानको हिसाब आदि लाई कृषि क्षेत्रको समग्र आधुनिकिकरणका प्रारम्भिक संकेतको रुपमा लिन सकिन्छ । कृषि क्षेत्रमा बढ्दो निजी लगानी यसको अर्को संकेत हो। हाल कृषि क्षेत्रको आधुनिकिकरणको प्रक्रियाको थालनी भए पनि समग्र ग्रामिण कृषि अर्थतन्त्रलाई रुपान्तरण गर्ने गरि यो प्रक्रिया तिव्र र वाह्य परिवेश सापेक्ष हुन सकेको छैन । कृषि क्षेत्रको सम्रग आधुनिकिकरणको प्रक्रियालाई तिव्र पार्न र बाह्य परिवेशसंग सामन्जस्यता ल्याउन आधुनिक कृषिका निम्न आयामहरुलाइ समावेश गरी आधुनिकिकरणको प्रक्रियाको थालनी गर्न प्रधानमन्त्री कृषि आधुनिकिकरण परियोजना शुरु गरिएको छ।

प्रधानमन्त्री कृषि आधुनिकिकरण परियोजनाले कृषि क्षेत्रको आधुनिकिकरणका लागि निम्न अनुसारका रणनीतिहरु सन्चालन गर्नेछ: भूमिको बैज्ञानिक उपयोग; आधुनिक कृषि प्रविधिहरुको अवलम्वन; कृषिमा यान्त्रिकिकरण; कृषि उपजहरुको प्रशोधन तथा बजारीकरण पूर्वाधारहरुको विकास; कृषि अनुसन्धान - शिक्षा - प्रसार प्रणालीको सुदृढ समन्वय एंव आधुनिकिकरण; प्रतिफलमा आधारित प्रोत्साहन प्रणालीको अवलम्वन; गुणस्तर नियन्त्रण तथा खाद्य स्वच्छता अभिबृद्धि; वातावरण परिवर्तन अनुकुलित कृषि प्रणाली अबलम्वन रहेको छ।

आन्तरिक संस्थागत जनशक्तिबाट दस्तावेज तयार भई नेपाल सरकारको आफ्नै स्रोतबाट सञ्चालन हुने गरी “कृषि विकास रणनीति” कार्यान्वयनको सहयोगी परियोजनाको रुपमा कृषिमा आधारित

अर्थतन्त्रबाट कृषिजन्य उद्योगमा रुपान्तरित आधुनिक, व्यावसायिक, दिगो एवम आत्मनिर्भर कृषि क्षेत्रको विकास गर्ने सोचका साथ नेपाल सरकार, मन्त्रिपरिषद्को मिति २०७३/०९/२६ को निर्णयबाट आ.व. २०७३/०७४ देखि प्रधानमन्त्री कृषि आधुनिकीकरण परियोजना १० वर्षको लागि नेपालका सातै प्रदेश, ७७ जिल्ला र ७५३ पालिकाहरुमा सञ्चालनमा रहेको छ। कृषि उत्पादन र उत्पादकत्व वृद्धिका लागि आवश्यक प्रविधि, पहुँच तथा उत्पादन सामाग्रीको व्यवस्था, बाली/वस्तुको उत्पादन लागत घटाउनको लागि यान्त्रिकरण एवम् पूर्वाधार विकास लगायतका क्रियाकलापमार्फत प्रशोधन तथा बजारीकरण गरी उत्पादनको मूल्य अभिवृद्धि गर्ने स्पष्ट मार्गचित्रका साथ नेपालको कृषि क्षेत्रको आधुनिकीकरणको परिकल्पना यस परियोजनामा गरिएको छ। कृषि क्षेत्रको समग्र विकासका लागि सरोकारवाला समुदायकै नेतृत्वले सहजीकरण गरी आधुनिकीकरणको प्रक्रियालाई तीव्र गति दिने सोचाई राखिएको यस परियोजनामा मुख्यतः चारवटा सम्भागहरुः साना व्यवसायिक कृषि उत्पादन केन्द्र (पकेट) विकास कार्यक्रम, व्यवसायिक कृषि उत्पादन केन्द्र(ब्लक) विकास कार्यक्रम,व्यवसायिक कृषि उत्पादन तथा प्रशोधन केन्द्र (जोन) विकास कार्यक्रम र वृहत व्यवसायिक कृषि उत्पादन तथा औद्योगिक केन्द्र (सुपरजोन) विकास कार्यक्रमको व्यवस्था गरी उत्पादन,प्रशोधन तथा औद्योगिकीकरणमार्फत कृषिमा आत्मनिर्भरताको दिशामा अगाडी बढ्ने अपेक्षा गरिएको छ। परियोजनाको दस्तावेजमा उल्लेख गरिएको अपेक्षित उपलब्धीहरुको हालसम्मको प्रगतिको अवस्था हेर्दा आ.व.२०७३/०७४ देखि देशभर ७७ जिल्लामा विशिष्टीकृत बाली वस्तुहरुमा पकेट, ब्लक, जोन र सुपरजोन स्थापना भई कार्यक्रम सञ्चालन भइरहेका छन्।

नेपालको कृषि विकासमा अथाह सम्भावना हुँदा पनि कृषकहरुले अपेक्षित लाभ लिन नसकेको कुरा सर्वविदितै छ। यसको पछाडी विविध कारणहरु छन् जसमध्ये उपयुक्त, नयाँ र प्रमाणित प्रविधीहरु कृषकस्तरमा पुऱ्याउन नसक्नु पनि एक हो। नेपाली कृषिको उत्पादकत्व कम हुनुको एउटा कारण कृषिमा आधुनिक भण्डारण प्रविधिको कम प्रयोग हो। नेपालमा कोल्ड रुम निर्माणको प्रचुर सम्भावना छ र हामीले हाम्रो कृषिलाई जलवायु-स्मार्ट बनाउन त्यसलाई प्रवर्द्धन गरिरहेका छौं। परियोजनाले हालसम्म विभिन्न जिल्लाहरुमा करिब ९० बटा कोल्डरुम निर्माणमा आर्थिक तथा प्राविधिक सहयोग गरिआएको छ तसर्थ कोल्ड रुम निर्माण तथा यस्को अवस्था तथा प्रभावकारितासँग सम्बन्धित विभिन्न विषय/पक्षहरु समेटेर तयार गरिएको यो पुस्तक महत्वपूर्ण छ।

शीतभण्डारसम्बन्धी कार्यविधिहरुः

कृषि विकास रणनीतिको कार्यान्वयनको सहयोगी परियोजनाको रुपमा रहेको प्रधानमन्त्री कृषि आधुनिकीकरण परियोजनाले विशिष्टिकृत बालीहरुको मूल्य शृंखलामा कार्य गर्दै आएको छ । प्रमुख कृषि उपजहरुको विशिष्टकृत क्षेत्रहरु निर्माण गर्दै प्रतिश्पर्धात्मक क्षमता अभिवृद्धि गरी मुल्य शृंखलाका

अवयवहरु, उत्पादन सामग्रीको उत्पादन तथा बजारिकरण, फार्म मेसिनरीहरुको सञ्चालन, उत्पादित कृषि उपजको सुरक्षित भण्डारण, प्रशोधन तथा विक्रि वितरण सम्बन्धी पुर्वाधारहरुको विकास सम्बन्धी अवधारणा यस परियोजनाको विशेषताको रुपमा रहेका छन्। विशिष्टकृत क्षेत्रहरुबाट उत्पादन भै आएका कृषि उपज खास गरी वीउआलु, फलफूल र तरकारीको सुरक्षित भण्डारण र भण्डारण क्षमता वृद्धिका लागि शित भण्डार गृह अपरिहार्य भएको छ। कृषि उपजहरुको उत्पादन उप्रान्तको क्षति न्यूनीकरण, गुणस्तर प्रवर्द्धन, आवश्यक परिमाणमा उपलब्धता सुनिश्चित गर्न र ब्यवसायिक तथा औद्योगिक उत्पादन एवं बजारिकरणका लागि शित भण्डार सुबिधा विकास गर्न स्वीकृत वार्षिक कार्यक्रममा व्यवस्था भए बमोजिम प्रतिस्पर्धाको आधारमा निजी कम्पनीसँग साझेदारीमा शित भण्डार गृह निर्माणका लागि ७०% पूँजिगत अनुदानमा मेशीनरी उपकरणहरु समेतको कार्य आ. व. ०७४/७५ मा स्वीकृत भएका तथा नयाँ थप हुने जिल्लाहरु समेत गरी क्रमागतरुपमा प्रधानमन्त्री कृषि आधुनिकीकरण परियोजनाले निजी क्षेत्रलाई वहुवर्षिय कार्यक्रम अन्तर्गत बढिमा २ वर्ष भित्र सम्पूर्ण निर्माण कार्य सम्पन्न गरी सञ्चालनमा ल्याउन जिल्लागत प्रतिस्पर्धा र लागत सहभागिताको आधारमा शित भण्डार गृह स्थापना कार्यक्रम कार्यान्वयन कार्यविधि-२०७४ (दोस्रो संसोधन २०७५) तयार गरी लागु गरेको छ।

कृषि उपजहरुको उत्पादन उपरान्तको क्षति न्यूनीकरण गर्न गुणस्तर प्रवर्धन गर्न आवश्यक परिमाणमा उपलब्धता सुनिश्चित गर्न र व्यवसायिक र औद्योगिक उत्पादन एवम् बजारीकरणमा सहयोग गर्न पर्याप्त भण्डारण सुविधा लागि शीतभण्डार निर्माण कार्यक्रम निजी वा सहकारी क्षेत्र र प्रदेश सरकारको साझेदारीमा निर्माण तथा व्यवस्थापन गर्न तीनतह सरकारद्वारा निर्माण गरिएका शीतभण्डार सम्बन्धी कार्यविधि र तिनका उद्देश्यहरु देहायबमोजिम रहेका छन् ।

कार्यविधिको नाम	उद्देश्यहरु
शित भण्डार गृह स्थापना कार्यक्रम कार्यान्वयन कार्यविधि-२०७४ (दोस्रो संशोधन २०७५)	(क) प्रधानमन्त्री कृषि आधुनिकीकरण परियोजना (PMAMP) अन्तर्गत विशिष्टिकृत क्षेत्रमा उत्पादित बाली र वस्तुहरुको गुणस्तर प्रवर्द्धन गरी बजारिकरणमा टेवा पुर्याउने । (ख) शित भण्डार गृह स्थापना र सञ्चालन मार्फत परियोजनाका सम्भागहरुमा उत्पादित कृषि उपजहरुको लागि पर्याप्त भण्डारण सुविधा उपलब्ध गराई उत्पादनोपरान्त क्षति न्यूनीकरण गर्दै, भण्डारण क्षमत वृद्धि गर्न आवश्यक परिमाण र उचित मूल्यमा सहज उपलब्धता गराउने ।

कार्यविधिको नाम	उद्देश्यहरु
	(ग) भण्डारण सुविधाको विकास मार्फत परियोजनाका सम्भागहरुमा संलग्न तथा आसपासका कृषकहरुलाई लक्षित बाली वस्तुहरुको थप उत्पादनका लागि प्रोत्साहन गर्ने । (घ) व्यवसायिक, औद्योगिक तथा निर्यातमूलक कृषि उत्पादन प्रवर्द्धनका लागि आवश्यक भण्डारण सुविधा उपलब्ध गराउने ।
शीतघर तथा खाद्यान्न भण्डारण घर स्थापना कार्यक्रमका लागि ब्याज अनुदान मापदण्ड २०७३	– कृषि उपजहरुको भण्डारणमा सहयोग पुर्याउने, – उत्पादन तथा उत्पादकत्व वृद्धि गर्न आवश्यक गुणस्तरीय बीउ विजनहरुको उपलब्धता सुनिश्चित गर्ने, – देशका उपभोक्तालाई गुणस्तरीय कृषि उपजहरुको उपलब्धता गराउने, – व्यवसायिक, औद्योगिक तथा निर्यातमूलक कृषि उत्पादन प्रवर्धनका लागि प्रयाप्त भण्डारण सुविधा प्रत्याभूत गर्ने, – कृषि उपज भण्डारण घर सञ्चालन र व्यवस्थापनबाट संस्थाको प्राविधिक तथा व्यवस्थापकिय क्षमता अभिवृद्धि गर्ने विषय समेटिएको छ ।
कृषि, पशुपन्छी, भूमि व्यवस्था र सहकारी क्षेत्र) रुपान्तरणको मार्गचित्र, २०७५	– कृषि उत्पादन सामग्रीको आपूर्ति व्यवस्थालाई सहज र सुलभ बनाई गुणस्तरीय बनाउन निजी क्षेत्र र सहकारी क्षेत्र समेतको सहभागितामा सातवटै प्रदेशमा बफर स्टकको लागि कम्तिमा २५ हजार मेट्रिक टन क्षमताका भण्डारण गृहहरू स्थापना गरिने, स्थानीय तहसँगको समन्वयमा आवश्यकता अनुसार शीतभण्डार, रस्टिक भण्डार, सेलार भण्डार, शुन्य शक्ति भण्डार जस्ता स्थानीय उत्पादनलाई सहयोग पुग्ने भण्डारण गृहहरु निर्माण गर्न प्रोत्साहित गरिने, कृषि उपजको व्यवस्थित भण्डारणका लागि ७ वटै प्रदेशमा सार्वजनिक निजी सहकारी क्षेत्रको सहभागितामा कम्तिमा १ लाख मेट्रिक टन क्षमताका ठूला गोदाम घर स्थापना गरिने, साना किसानहरूको उत्पादन एवम् बजारीकरणलाई टेवा पुर्याउन स्थानीय तहमा सामुदायिक अन्न तथा बीउ बैंकको स्थापना गर्न प्रोत्साहन गरिने उल्लेख छ ।

कार्यविधिको नाम	उद्देश्यहरु
कृषि उपज भण्डारणका लागि प्रयोग गरिने शीतघर तथा दुग्ध चिस्यान केन्द्रमा लाग्ने विद्युत महशुलमा अनुदान भुक्तानी दिने सम्बन्धी कार्यविधि, २०७५	– कृषि उपज भण्डारणमा प्रोत्साहन गर्ने र दिगो रुपमा शीतघर सञ्चालनका लागि सहयोग पुर्याउने, स्थानीय स्तरमा दुग्ध संकलन, चिस्यान केन्द्र स्थापना तथा सञ्चालनमा सहयोग पुर्याउने, दुग्ध चिस्यान केन्द्र तथा शीतघरमा कृषि उपज भण्डारण गर्दा प्रयोग हुने विद्युतमा सञ्चालकले तिर्ने महशूलमा अनुदानको व्यवस्था गरी भण्डारण सुविधाको सुलभता गराई उत्पादनलाई प्रोत्साहन गर्ने, शीतघर सञ्चालन मार्फत कृषि उपजहरुलाई पयाप्त भण्डारण सुविधा उपलब्ध गराई उपभोक्तालाई गुणस्तरीय कृषि उपजहरुको उपलब्धता सुनिश्चित गर्ने, कृषिमा संलग्न व्यवसायी तथा उद्यमीहरुलाई प्रोत्साहित गर्ने तथा भण्डारण जोखिम न्यूनीकरणमा सहयोग गर्ने, भण्डारण सुविधाको विकास मार्फत कृषि उपजको मूल्य अभिवृद्धि गर्दै वेमौसमी उपलब्धता गराउनमा सहयोग गर्ने विषय समेटिएको छ ।
शीतभण्डार गृह (कोल्ड स्टोरेज) स्थापना कार्यान्वयन कार्यविधि २०७४, प्रथम संशोधन २०७५	– विशिष्टकृत क्षेत्रहरुबाट उत्पादन भई आएका कृषि उपज खास गरी वीउ आलु फलफूल र तरकारीको सुरक्षित भण्डारण र भण्डारण क्षमता वृद्धि, कृषि उपजहरुको उत्पादन उप्रान्तको क्षति न्यूनीकरण, गुणस्तर प्रवर्धन, आवश्यक परिमाणमा उपलब्धता सुनिश्चित गर्न र व्यवसायिक तथा औद्योगिक उत्पादन एवम् बजारका लागि शीतभण्डार सुविधा विकास गर्न निजी कम्पनीसँग साझेदारीमा शीतभण्डार निर्माणका लागि अनुदान दिने गरी कार्यविधि तयार, शीतभण्डारण गृह स्थापना र सञ्चालन मार्फत उत्पादित कृषि उपजहरुको लागि पर्याप्त भण्डारण सुविधा उपलब्ध गराई उत्पादनोपरान्त क्षति न्यूनीकरण गर्दै भण्डारण क्षमता वृद्धि गर्न आवश्यक परिमाण र उचित मूल्यमा सहज उपलब्धता गराउने र व्यवसायिक औद्योगिक तथा निर्यातमूलक कृषि उत्पादन प्रवर्धनका लागि आवश्यक भण्डारण सुविधा उपलब्ध गराउने उल्लेख छ ।

त्यस्तै, प्रदेशहरुले पनि शीतभण्डार निर्माण र अनुदान सम्बन्धी कार्यविधि, साझेदारीमा कोल्ड स्टोर/चिस्यान केन्द्र/कोल्ड रुम स्थापना कार्यक्रम सञ्चालन कार्यविधि पारित गरी कार्यान्वयनमा ल्याएका

छन् । कृषि तथा पशुपन्छी मन्त्रालय, कृषि विभाग, प्रधानमन्त्री कृषि आधुनिकीकरण आयोजना, प्रदेश कृषि मन्त्रालय तथा कृषि निर्देशनालय र स्थानीय तहबाट सञ्चालित विभिन्न कार्यक्रमहरु मार्फत कृषकहरुको कृषि उपजहरुको सुरक्षित भण्डारण र भण्डारण क्षमता वृद्धि गर्न, खाद्य सुरक्षा र गुणस्तर अभिवृद्धि, कृषि उपजको मूल्य अभिवृद्धि कृषि क्षेत्रको व्यवसायिक औद्योगिक विकास र कृषि बजार व्यवस्थापनका लागि विभिन्न प्रकारका अनुदान कार्यक्रममा लगानी गरेको छ ।

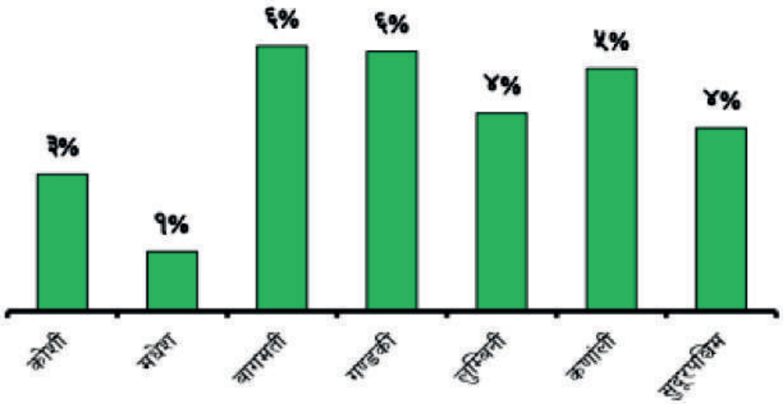
महालेखापरिक्षकको कार्यालय प्रतिवेदन २०८२ का सकारात्मक पक्षहरू

नेपालमा शीतभण्डार व्यवस्थापन कार्यक्रम कृषि उत्पादन, आपूर्ति श्रृङ्खला व्यवस्थापन र आर्थिक गतिविधि सुधारका सन्दर्भमा सकारात्मक प्रभाव रहेको छ। शीतभण्डारमार्फत् फलफूल, पुष्प, तरकारी लामो समयसम्म ताजा राख्न मद्दत पुगेको, मौसमी उत्पादनको दीर्घकालीन भण्डारणमार्फत प्रतिस्पर्धी बजार मूल्य प्राप्त भएको, खाद्य सुरक्षामा सुधार भएको, उत्पादन तत्काल बेच्नुपर्ने बाध्यता न्यून भई अधिक लाभ प्राप्त हुने अवसर प्राप्त भएको, निर्यात प्रवर्धन गर्न सहयोग मिलेको, उत्पादक, वितरक, र खुद्रा विक्रेताबीचको आपूर्ति व्यवस्थापन, जनशक्तिका लागि रोजगारीको अवसर प्राप्त हुनुका साथै वैज्ञानिक भण्डारण प्रणालीलाई प्रवर्धन भई कृषिमा आधुनिकिकरण गर्न अवसर रहेको लगायतका सकारात्मक पक्षहरू रहेका छन् ।

- **सुधार गर्नुपर्ने पक्षः** शीतभण्डार व्यवस्थापन कार्यक्रमसम्बन्धमा देखिएका सुधार गर्नुपर्ने पक्षहरू निम्न रहेका छन्-

१. **नेपालमा शीतभण्डारको आवश्यकता -** तरकारी तथा फलफूल द्रुत गतिमा बिग्रने हुँदा ताजा अवस्था लामो समयसम्म कायम राख्न तथा व्यावसायिक रूपमा नोक्सानी कम गर्न उचित भण्डारण आवश्यक हुन्छ। कृषि उपजमा हुने गुणस्तरलाई संरक्षण गरेर राख्नको लागि चिस्याउने प्रक्रिया नै मूल आधार हो किनकि यसले भण्डारण गरिएको उपजमा रासायनिक प्रक्रियाहरू कम गराउनका साथै सुक्ष्म जिवाणुहरूको वृद्धि पनि कम गराउँछ । शीतभण्डारको क्षमता अनुसार चिसो गर्ने यन्त्रको (रेफ्रीजिरेटर) क्षमता बढी वा घटी हुने भएपनि शीतभण्डारको वातावरणलाई सजिलोसँगै नियन्त्रण गर्न सकिने गरी भण्डारलाई विभिन्न कक्षमा बाँडिएको हुन्छ । तरकारी तथा फलफूललाई उपर्युक्त वातावरणमा भण्डारण गरेर राख्न सकेमा कृषि उपजको गुणस्तर कायम गर्दै उपभोक्ताको माग र बजार मूल्य अनुसार उचित समयमा आफ्नो उपज विक्रि गरी आर्थिक लाभ लिन सकिन्छ । नेपालमा निर्माण भएका शीतभण्डारहरुले फलफूल तथा तरकारीहरुको भण्डारण गर्दा तापक्रम, सापेक्षित आर्द्रता र भण्डारण अवधिलाई ध्यान दिनुपर्दछ । यस्ता कृषि उपजलाई भण्डारण गरी आवश्यकता अनुसार विक्रि गर्न उपर्युक्त तापक्रमअनुसार शीतभण्डार निर्माण गर्ने र कृषक तथा शीतभण्डार सञ्चालकलाई आवश्यक तालिम र ज्ञान हस्तान्तरण कार्यक्रम सञ्चालन गरी सोको प्रभावकारी उपयोग गर्नुपर्दछ ।

२. **कृषिउपज शीतभण्डार केन्द्रको सुविधा** - शीतभण्डारण केन्द्रको सुबिधाले कृषकहरुले आफ्ना कृषिजन्य उत्पादन निश्चित समयका लागि शुन्य वा कम क्षतिमा सुरक्षित तवरले राख्न सक्दछन्। यसबाट कृषकहरुले सम्भावित हानी नोक्सानीबाट आफ्ना फसलहरुको संरक्षण गर्नसक्नुका साथै उच्च प्रतिफल लिन सक्दछन्। कृषि गणना, २०७८ ले देखाएको विवरणबाट कूल उत्पादन मध्ये शीतभण्डार व्यवस्थापनमा वडागत शीतभण्डारको तथ्याङ्क देहायबमोजिम रहेको छ ।



स्रोतः कृषिमा सरकारी सेवा सुविधाको पहुँचसम्बन्धी विषयगत प्रतिवेदन

३. **फलफूल भण्डारणका लागि कोल्ड स्टोर** - राष्ट्रिय फलफूल विकास केन्द्रले आ.व. २०७७/७८ मा गरेको अध्ययन अनुसार देशभर रहेका शीतभण्डारहरुको विवरण देहायबमोजिम रहेको छ। स्रोतः राष्ट्रिय फलफूल विकास केन्द्र २०७७/७८

प्रदेशको नाम	कोल्ड स्टोर संख्या
कोशी	१८
मधेश	२६
बागमती	३२
गण्डकी	८
लुम्बिनी	३२
कर्णाली	१
सुदुरपश्चिम	९
कूल	१२६

४. **डिजाइन तथा प्रविधि सम्बन्धी तालिम** - शीतभण्डारको सञ्चालन गर्न सम्बन्धित साझेदार संस्थाको कर्मचारीलाई आवश्यक प्राविधिक तालिमको व्यवस्थापन गर्नुपर्दछ । कृषि उपज टिप्ने, सङ्कलन गर्ने तथा भण्डारण गर्ने बारे पर्याप्त ज्ञान सञ्चालक तथा कृषकमा हुनुपर्दछ । शीतभण्डारमा प्राविधिक ज्ञानको अभावका कारण कृषि उपजहरु कुहिएर गएका छन् । गण्डकी प्रदेशका ४ शीतभण्डारहरुमा दक्ष जनशक्ति नभएको र कृषकस्तरमा सञ्चालन गरिएका कतिपय साना चिस्यान केन्द्र तथा शीतभण्डारको एकपटक प्रयोग गरेपछि मर्मतसम्भार तथा निर्मलीकरणमा कृषकहरूलाई प्राविधिक सहजीकरण गरेर दिगो र प्रभावकारी उपयोग गर्न नसकिएको अवस्था छ । त्यस्तै, सुदुरपश्चिम प्रदेशका १४ शीतभण्डारहरुमा दक्ष जनशक्ति नभएको विवरण प्राप्त भयो । निर्माण व्यवसायी र तहगत सरकारको प्राविधिक सहकार्यमा कृषक, सहकारी तथा कृषि प्रसार कार्यकर्तालाई उपकरण प्रयोगसम्बन्धी सीप र तालिम प्रदान गरी शीतभण्डारको सञ्चालन दक्षता अभिवृद्धि गर्नुपर्दछ।

५. **शीतभण्डारका कृषि उपजको बीमा** - शीतभण्डारमा भण्डारण गरिएका कृषि उत्पादनहरू विभिन्न प्राकृतिक, प्रविधीगत र मानवीय कारणले हुने क्षतिबाट कृषक तथा व्यवसायीहरूलाई जोगाउन शीतभण्डार कृषि उपज बीमा (Cold Storage Crop Insurance) आवश्यक हुन्छ। नेपाल सरकारद्वारा अनुदानमा आधारित कृषि बीमा योजनाले कृषकलाई ८० प्रतिशतसम्म बीमा प्रिमियममा अनुदान दिने गरेकोमा बीमाप्रति सचेतनाको अभाव, बीमा कम्पनीहरूको सीमित पहुँच, शीतभण्डार कृषि उपजमा बीमासम्बन्धी स्पष्ट कानुनी तथा नीतिगत व्यवस्था लगायतका कारण लुम्बिनी प्रदेशका ७ शीतभण्डारका कृषि उपजको बीमा गरेको छैन । त्यस्तै, प्रधानमन्त्री कृषि आधुनिकीकरण परियोजनाबाट निर्माण गरिएका शीतभण्डारमा समेत शीतभण्डारमा राखिएका कृषि उपजमा बीमा गरिएको छैन । सहकारी तथा निजी क्षेत्रबीच सहकार्य गरी बीमा सेवालाई ग्रामीण क्षेत्रमा विस्तार गर्ने र कृषकहरूलाई बीमासम्बन्धी जानकारी दिई कृषि उपजको बीमा गर्नुपर्दछ ।

६. **सम्भाव्यता अध्ययन** - शीतभण्डार गृह कार्यक्रम कार्यविधि, २०७४ को बुँदा ४.१ मा शीतभण्डार गृह स्थापना कार्यक्रम विशिष्टीकृत उत्पादन क्षेत्रबाट उत्पादन नै आउने र बजारीकरणका दृष्टिकोणले सम्भाव्य तथा महत्वपूर्ण रहेका एवम् कार्यक्रममा समाविष्ट भएका जिल्लाहरूमा सञ्चालन गरिने र शीतभण्डार स्थापना गर्न आवश्यक परिमाणमा कृषि उत्पादनको सम्भाव्यता भएको हुनुपर्ने उल्लेख भएकोमा सम्भाव्यता, नीतिगत तथा कानुनी आधार, सञ्चालन मोडालिटी एवम् दिगोपना लगायतका विषयमा पर्याप्त. अध्ययन एवम् विश्लेषण गर्नुपर्ने उल्लेख छ । शीतभण्डार निर्माण र सञ्चालन गर्नुपूर्व बजार, प्राविधिक, आर्थिक तथा सामाजिक तथा वातावरणीय सम्भाव्यता अध्ययनबाट शीतभण्डार स्थापनाको उपयुक्त स्थान, लागत, प्रविधिसम्बन्धी

विश्लेषण वेगर शीतभण्डारहरु निर्माण गरी सञ्चालन भएको पाइयो । जसबाट उच्च प्रारम्भिक लागत, विद्युत आपूर्तिको अस्थिरता, सञ्चालन भएका शीतभण्डार पूर्ण क्षमतामा सञ्चालन नहुनु, सञ्चालन तथा मर्मत लागत र दक्ष जनशक्तिको अभाव लगायतका समस्याहरु देखिएको छन्। शीतभण्डारको निर्माण गर्नुपूर्व सम्भाव्यता अध्ययन गरी शीतभण्डारको आवश्यकता हुने स्थानमा मात्र शीतभण्डारको निर्माण गरी सञ्चालन गर्नुपर्दछ ।

७. **फोहोरमैला व्यवस्थापन** - शीतभण्डारहरुमा फोहोरमैला व्यवस्थापन एक महत्वपूर्ण प्रक्रिया हो, जसले खाद्य सुरक्षा, सरसफाइ र वातावरणीय प्रभावलाई नियन्त्रणमा राख्छ। शीतभण्डारमा जैविक, अजैविक र रसायनिक फोहोरहरु उत्सर्जन हुने तथा यसले जनस्वास्थ्य तथा कृषि भण्डारमा असर पर्न हुँदा फोहोरमैलाको उचित व्यवस्थापन अनिवार्य हुनुपर्दछ । सही व्यवस्थापनले उत्पादनको गुणस्तर जोगाउँछ र स्वास्थ्य जोखिम कम गर्छ। ठूला शहरी क्षेत्रमा रहेको शीतभण्डारहरुले उत्सर्जित फोहोरहरु नगरपालिकाको संयन्त्र मार्फत व्यवस्थापन भएतापनि साना शहर, ग्रामीण क्षेत्रमा भने यस्को व्यवस्थापन हुन सकेको छैन । तसर्थ, फोहोर व्यवस्थापनको उचित रणनीति अप्नाई फोहोरको पुनःप्रयोग, उर्जा उत्पादन जस्ता नवीन अवधारणाहरु अवलम्बन गर्नुपर्दछ।

कृषि उपजहरुको गुणस्तर कायम गर्न, उत्पादन उपरान्त क्षति न्यूनीकरण गर्न तथा स्थानीय कृषि उपजहरुको बाह्रै महिना उपलब्धता सुनिश्चित गरी आयात प्रतिस्थापन गर्न शीतभण्डार संरचनाको आवश्यकता रहेको तर निर्माण सम्पन्न भएका शीतभण्डारको उपयोग हुन सकेको छैन । संघ, प्रदेश र स्थानीय तहले निर्माण प्रारम्भ थालेका कतिपय शीतभण्डारको निर्माण कार्य सम्पन्न हुन नसकी लगानीको सदुपयोग हुन सकेको छैन । कृषकले उत्पादन गरेका कृषि उपजको भण्डारण गरी बजारको माग अनुसार आपूर्ति गर्ने तथा उत्पादनमा हुने नोक्सानी कम गरी आम्दानी बढाउने उद्देश्यले शुरु भएको शीतभण्डार गृहहरुको निर्माण, सञ्चालन एवम् दिगो व्यवस्थापनमा थप प्रयास आवश्यक देखिन्छ।

विभिन्न निकायको अनुदानबाट शीतभण्डार निर्माण भए पनि एकीकृत अभिलेख छैन । सम्भाव्यता अध्ययनका आधारमा उपयुक्त स्थानमा निर्माण गर्ने, निर्माण भईसकेकाको हकमा पूर्ण क्षमतामा सञ्चालन गर्ने, अधुरा पूर्वाधारहरु समयमै सम्पन्न गर्ने, नयाँ निर्माण हुने तथा प्रभावकारी रुपमा सञ्चालन भईरहेका पुराना शीतभण्डारहरुमा लोड अनलोडका लागि स्वचालित विद्युतीय ईलिभेटर प्रणाली जडान गरी भण्डारण लागत घटाउने, सञ्चालन मोडालिटी तयार गरी कार्यान्वयन गर्ने, दक्ष कामदार स्वदेशमै तयार गर्न प्राविधिक तालिमका साथै सीप विकास कार्यक्रम सञ्चालन गर्ने, शीतभण्डार अनुदान प्राप्त गरेका निजी क्षेत्र/संस्थाले स्थानीय कृषकहरुलाई सहुलियत दरमा भण्डारण सुविधा दिने र सोको अनुगमन गर्ने साथै शीतभण्डारको विद्युत महशुल छुट दिने विषयमा

नीतिगत निर्णय गर्ने लगायतका सुझावहरू कार्यान्वयन गरी शीतभण्डारको निर्माण, सञ्चालन र उपयोग गर्नुपर्दछ।"

देशको भौगोलिक परिवेश, कृषि अनुसन्धान, विज्ञान तथा ईन्जिनियरीङ्ग शिक्षाको अवस्था, वीउविजन, पानी, यन्त्र, प्रविधी लगायतका उत्पादनका श्रोत साधन, तुलनात्मक लाभ र राष्ट्रिय आवश्यकता, दिगो विकास लक्ष्य २०३० आदिलाई मध्यनजर गरी सरकारी, निजी तथा सहकारी साझेदारीको अवधारणा अंगिकार गर्दै कृषि पेशालाई आकर्षक र सम्मानजनक वनाई कृषि क्षेत्रको औद्योगिकीकरण मार्फत आर्थिक रुपान्तरण गर्दै राष्ट्रिय अर्थतन्त्रलाई वलियो बनाउनु आजको आवश्यकता हो। यही पृष्ठभूमिलाई मध्यनजर गर्दै कृषि क्षेत्रको उत्पादन र उत्पादकत्व वृद्धि गर्ने स्पष्ट मार्गचित्रका साथ कृषि उपज उत्पादनका लागि आवश्यक प्रविधी तथा उत्पादन सामाग्रीको व्यवस्था, वाली/वस्तु उत्पादनमा यान्त्रिकरण, प्रशोधन तथा बजारीकरणको लागि आवश्यक पूर्वाधारको व्यवस्था जस्ता कृयाकलापहरु मार्फत कृषि क्षेत्रको समग्र विकास गर्न प्रधानमन्त्री कृषि आधुनिकीकरण परियोजना प्रतिवद्ध भएर लागि परेको छ। यस परियोजनाले नेपालको संविधानले प्रत्याभुत गरेको खाद्य सम्प्रभुताको हकलाई पूरा गर्न भौगोलिक सम्भाव्यता र तुलनात्मक लाभका आधारमा बाली वस्तुहरुको विशिष्टीकरण, यान्त्रिकरण र औद्योगिकीकरणका माध्यमबाट कृषि क्षेत्रको रुपान्तरण गर्ने सोच लिई काम गरिरहेको छ।

पछिल्लो समय, नेपालको कृषि क्षेत्रमा आधुनिकीकरणका परिदृश्यहरु स्पष्ट देखिन थालेका छन्। विशेषगरी यान्त्रिकरण, कृषिमा ड्रोन तथा बजारको मागमा आधारित कृषि उपज उत्पादन, संरक्षित कृषि ईन्जिनियरिङ्ग संरचनाहरुको प्रयोगमा व्यापक विस्तार, कृषि क्षेत्रमा बढ्दो निजी लगानी, यूवाहरुको आकर्षण, कृषि फर्मको नाफा नोक्सान विश्लेषण गर्ने प्रचलन तथा कृषिमा ईन्जिनियरीङ्ग र प्रविधीहरुको बढ्दो प्रयोग आदिलाई कृषि क्षेत्रको औद्योगिकीकरणको लागि तयार भईरहेको मजबुत आधार मान्न सकिन्छ। तथापी आर्थिक, भौगोलिक, प्राविधीक तथा प्रविधीजन्य कारणहरुले गर्दा समग्र ग्रामीण कृषि अर्थतन्त्रलाई रुपान्तरण गर्ने गरी यो प्रकिया तिब्र र बाह्य परिवेश सापेक्ष हुन सकेको छैन।

यसै सन्दर्भमा कृषि क्षेत्रको समग्र आधुनिकीकरणको प्रक्रियालाई साकार गर्न प्रधानमन्त्री कृषि आधुनिकीकरण परियोजनाले जम्मा आठ वटा रणनितीहरु अवलम्वन गरेको छ, जसमध्ये "आधुनिक कृषि प्रविधीहरुको अवलम्बन" एउटा हो।

3 Methodology

3.1 Study Area

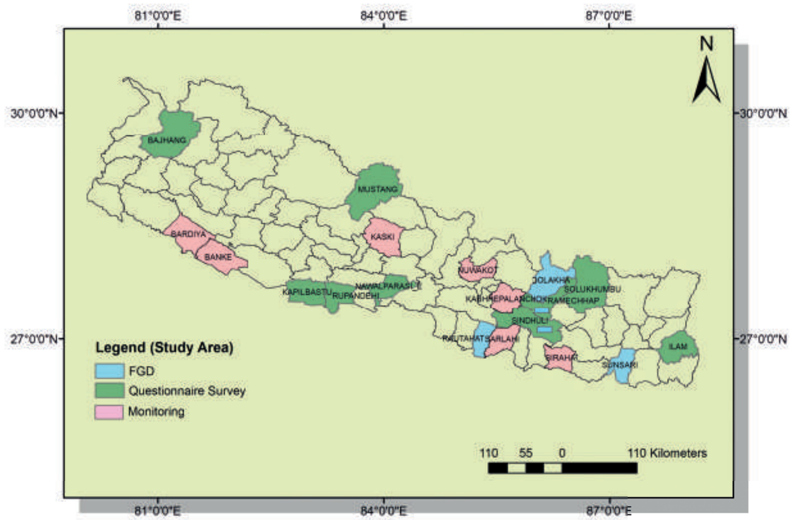


Fig 3.1: Study Districts for survey on the condition and effectiveness of cold chambers/cold rooms established by PMAMP from field engineers

The study area for this research encompasses three major agro-ecological regions of Nepal: the Himalayan, Hill, and Terai regions. These regions represent distinct climatic zones—cold, temperate, and sub-tropical respectively characterized by significant variations in altitude, temperature, and agricultural practices. Specifically, the Himalayan region includes high-altitude areas with cold climates, the Hill region covers mid-altitude temperate zones, and the Terai region consists of lowland sub-tropical plains. This geographic diversity provides a comprehensive setting to assess the effectiveness and utilization of cold rooms established under the Prime Minister Agriculture Modernization Project (PMAMP).

3.2 Study Design

This assessment adopted a mixed-method approach combining quantitative surveys, qualitative field observations, GIS mapping, and engineering verification to evaluate the status and effectiveness of cold rooms/cold chambers constructed under PMAMP.

3.3 Sampling Approach

Out of the 87 cold rooms constructed under PMAMP, a purposive sample of 25 sites was selected to ensure balanced representation. The sampling considered geographical diversity across provinces and ecological zones; Mountain, Hill, and Terai, as well as a variety of stored commodities such as vegetables, fruits, dairy, and seeds. It also included different operational models, including those managed by community groups, cooperatives, and private entities.

The 25 selected sites were assessed by PIU engineers through a structured questionnaire survey, while the PMU team conducted 5 Focus Group Discussions (FGDs) and field monitoring in key districts, including major cold rooms and storage facilities in Nuwakot and Banke. These activities provided firsthand insights into functionality and effectiveness.

3.4 Data Sources and Collecting Tools

Primary data for this study were collected through field surveys, interviews, and Focus Group Discussions (FGDs). Field surveys were conducted at 25 selected cold room sites across the Mountain, Hill, and Terai regions to assess their operational status, infrastructure, and usage. FGDs were organized with farmers, user groups, cooperatives, and cold room operators to gather qualitative insights on accessibility, effectiveness, and community involvement. Key Informant Interviews (KIIs) were also held with local technicians, project engineers, and PMAMP staff to understand technical and management aspects.

Secondary data were obtained from official project records, including an inventory of 86 cold rooms constructed under PMAMP, project guidelines, engineering designs, progress reports, and monitoring documents. Additionally, GIS-based geospatial data were used to map the locations of surveyed cold rooms and analyze their proximity to production areas and markets. Various data collection tools such as structured questionnaires, engineering inspection checklists, and FGD guides were employed to capture both quantitative and qualitative information on the cold rooms' condition, performance, and community impact.

3.5 Data Analysis

Quantitative data collected from structured questionnaires were compiled and analyzed using Microsoft Excel and basic statistical tools to assess the utilization rates, operational status, and regional variations among the 25 surveyed cold rooms. Metrics such as storage occupancy, frequency of use, seasonal trends, and commodity types were compared across ecological zones (Mountain, Hill, Terai) and provinces. The analysis also included evaluation of the cold rooms' physical condition, availability of backup power systems, and maintenance practices. These insights were used to measure the effectiveness of cold rooms in preserving perishable agricultural products and supporting post-harvest management. Furthermore, the findings contributed to evaluating the cold rooms' alignment with PMAMP's goal of enhancing agricultural productivity through improved storage infrastructure, particularly in relation to reducing post-harvest losses and maintaining commodity quality.

Qualitative data obtained from Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were analyzed thematically to capture user perspectives, local knowledge, and social dynamics related to cold room use. This analysis focused on identifying success stories, key challenges in management and access, the extent of community participation, gender roles in operation and decision-making, and perceived economic benefits. These narratives offered a deeper understanding of the social dimensions of cold room effectiveness, including inclusivity, affordability, and sustainability of the interventions. Additionally, GIS analysis was used to assess spatial patterns and coverage gaps, helping visualize the accessibility of cold storage infrastructure in relation to major production belts and underserved regions. The integration of qualitative, quantitative, and spatial data enabled triangulation of findings and ensured a comprehensive analysis aligned with the study's objectives.

3.6 Validation and Triangulation

To ensure the reliability and accuracy of findings, data were validated through a triangulation approach that integrated multiple sources and methods. Field survey results were cross-verified with official records obtained from the respective Project Implementation Units (PIUs) to confirm the status and specifications of each cold room. Observations made by the engineering inspection team were compared against usage data and feedback provided by cold room operators, helping to identify any discrepancies in performance reporting. Additionally, insights gathered through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were used to corroborate and contextualize quantitative data, providing a richer understanding of user experience, challenges, and impact. This multi-layered validation process enhanced the credibility of the findings while minimizing potential bias.

4

Results and Discussion

4.1 Technical Report of Cold Rooms/Cold Chambers from Field Engineer

4.1.1 PMAMP PIU, Okhaldhunga

1. **Cold Room Owner: Pemba Sherpa**

The cold chamber located in Solududhkunda-2, Solukhumbu has a capacity of 6 tons with one chamber and is used exclusively for storing kiwi. It operates at a temperature of 2–3°C, 24 hours a day, utilizing 3.5 kWh of grid electricity. The facility is fully utilized (100%) from Kartik to Chaitra, with a monthly operating cost of Rs. 1,600 (entirely for energy). Although the setup cost was Rs. 7 lakhs (excluding a shed), it received a subsidy of Rs. 4.5 lakhs from PMAMP. The chamber generates around Rs. 11,000 per month in revenue, but the profit margin has not been estimated. Monitoring is limited to temperature only, with no alarm system in place. Reported issues include early ripening, reduced weight of stored produce, and inadequate response from the manufacturer. Spoilage is around 3–5%, with no specific measures for loss reduction. Despite these challenges, feedback indicates that the service is good, though the booth size is considered too small.

2. **Cold Room Owner: Jyangbu Sherpa**

The cold chamber located in Solududhkunda-7, Solukhumbu has a storage capacity of 4 tons and is used for storing kiwi, though it operates at only 50% utilization. It maintains a temperature of 5°C and consumes 3.8 kWh of electricity. The setup cost was Rs. 5 lakhs, with no shed and no subsidy received. It operates mainly during Baisakh and from Mangsir to Chaitra, generating revenue of Rs. 100–120 per kg per season. The only reported issue is weight loss, with spoilage ranging from 2–3%. Despite the limited capacity, user feedback is highly positive, citing excellent service, though the chamber is considered too small for the volume of produce. There are no existing training or waste management practices, and users have expressed the need for training, maintenance guidance, and facility upgrades to enhance performance.

3. **Cold Room Owner: Pema Sherpa**

The cold chamber in Solududhkunda-9, Solukhumbu has a storage capacity ranging from 5 to 7 tons but operates at just 30% utilization. It maintains a temperature of 2–3°C and uses 4.2 kWh of energy daily. The total setup cost was Rs. 7.75 lakhs, with a subsidy of Rs. 1.75 lakhs provided by PMAMP. Monthly operational and maintenance costs are Rs. 1,000 and Rs. 5,000 respectively, with an average monthly revenue of Rs. 10,000. Despite receiving good service overall, users have reported poor manufacturer response and issues like fruit rotting, swelling, and softening. Spoilage is estimated at 1–2%. The facility lacks waste management practices, staff training, and an upgrade plan. There is a strong need for operational guidance and capacity-building support for staff to improve functionality.

4. **Cold Room Owner: Sonam Lama**

The cold chamber in Solududhkunda-4, Solukhumbu has a 3-ton capacity with one chamber and is fully utilized. Operating at 2°C and consuming 3.8 kWh of energy daily, it was established at a cost of Rs. 5.5 lakhs without a shed, with Rs. 3 lakhs subsidized by PMAMP. Monthly operational costs range from Rs. 2,200 to Rs. 2,300, and the facility generates seasonal revenue of Rs. 80–100 per kg, with an estimated profit of Rs. 30,000. Despite its full usage, challenges include periodic AC shutdowns, early ripening of stored produce, and a very small chamber size. Spoilage is reported at 2–3%, and fungal cleaning is done as a preventive measure. The users have expressed a need for PUF panel installation and reported a lack of training and technical guidance.

5. **Cold Room Owner: Keshav Rai**

Located in Thulung Dudhkoshi-8, Solukhumbu, this cold chamber has a capacity of 5–7 tons and is fully utilized. It operates at a temperature range of 6–8°C, consuming 4.5 kWh of energy daily, and was established at a cost of Rs. 8 lakhs, with Rs. 3 lakhs subsidized by PMAMP. Monthly operational and energy costs are each under Rs. 3,000. Seasonal revenue ranges from Rs. 50 to Rs. 100 per kg. The facility faces technical issues such as bruising of produce and power outages, leading to an estimated spoilage of around 10%. Loss reduction practices include sorting, cleanliness, and effective marketing. Users have provided excellent feedback but emphasized the need for training, improved quality assurance, increased storage capacity, local repair services, and better transportation facilities.

Table 4.1 Combined Summary of Technical Report from Solukhumbu District

Aspect	Observations
Common Products Stored	Primarily Kiwi (also Orange and other fruits)
Typical Storage Capacity	3–7 tons
Utilization Range	30% – 100%
Temperature Range	2°C – 8°C
Spoilage Rate	1% – 10%
Subsidy Access	4 out of 5 respondents received government subsidies
Common Issues	Early ripening, poor response from manufacturers, technical faults

Aspect	Observations
Training Availability	Largely lacking; most users demand training and guidance
Waste Management	Poorly implemented except composting from spoiled fruit in a few cases
Upgrades Needed	Larger capacity, PUF panels, proper maintenance & operation training
Future Demand	Very high current and projected demand
User Feedback	Mostly good to excellent service experience, but high need for system upgrades

Fig 4.1 Highlights of survey at Okhaldhunga district

4.1.2 PMAMP, PIU, Aacham

1. **Cold Room Owner :** श्री खागडा कृषक समूह **(Deepak Raj Joshi)**

   Located in Jayaprithvi Municipality-07, Subeda, Bajhang, Sudurpaschim, the 5 MT capacity cold room constructed in FY 2080/81 and owned by a local farmers' group is primarily used for storing seed potatoes along with other fruits and vegetables for 3–4 months at a maintained temperature of 4°C. Despite being connected to the grid, the cold room operates only 4–5 hours daily due to frequent electricity fluctuations and lacks a generator, making energy inconsistency a major issue. Built at an approximate cost of NPR 10.9 lakh, with annual operational expenses of around NPR 85,000, it is used informally by group members without any rental fees, and thus lacks a formal business model, operating at about 60–70% capacity. Seasonal operation during Jestha to Bhadra and Mangsir to Magh yields sales prices of Rs. 4200+ per quintal, though post-storage quality sometimes declines due to shrinkage and sprouting. Without formal training or local technician support, maintenance relies on occasional services from Kathmandu and regular internal cleaning, but spoilage still ranges from 5–15%. Despite high demand, challenges like unreliable electricity, lack of skilled manpower, and inadequate training highlight the need for a generator and capacity-building efforts.

Fig 4.2 Cold room constrcted by Deepak Raj Joshi at Jayaprithvi Municipality-07, Subeda, Bajhang

2. **Cold Room Owner :** श्री सिदार्थ फलफुल कृषक समूह (Rangi Bohara)

The cold room located in Surma Rural Municipality-01, Bajhang, Sudurpaschim, with a 5 MT capacity and single chamber, was constructed in FY 2080/81 for storing seed potatoes and apples for 4–5 months at 4°C. Operated 8 hours daily using only grid electricity without a backup generator, the facility costing approximately NPR 21.22 lakh is group-owned and sees around 80% utilization, mainly during Jestha–Shrawan and Mangsir–Magh. Although it helps maintain post-storage quality close to fresh harvests, challenges include frequent electricity issues, limited farmer awareness, no prior maintenance beyond basic cleaning, and only basic training provided. Storage rent varies from Rs. 2200–4000 depending on the season, while sales prices range from Rs. 1800–4000. Revenue is estimated between NPR

20,000–30,000, with a spoilage rate of 5–10%. There is a high demand for storage beyond 5 MT, highlighting the need for a generator, advanced training, and awareness programs to maximize its potential.

Fig 4.3 Cold room constrcted by Rangi Bohara at Surma Rural Municipality-01, Bajhang

Table 4.2 Combined Summary of Technical Report from Bajhang District

Aspect	Observations
Common Products Stored	Seed potatoes (primary), apples, and other vegetables
Typical Storage Capacity	5 metric tons per cold room
Utilization Range	Khagada: 60–70%; Siddhartha: ~80%
Operating Hours	Khagada: 4–5 hours/day; Siddhartha: 8 hours/day
Storage Duration	3–5 months
Temperature Range	4°C
Spoilage Rate	Khagada: 5–15%; Siddhartha: 5–10%
Revenue Model	Khagada: Informal, no rent charged; Siddhartha: Seasonal rent (Rs. 2200–4000), NPR 20,000–30,000 revenue
Power Supply	Grid electricity only, no generator backup; frequent power fluctuations
Maintenance & Training	No formal maintenance or user training at either site
Waste Management	Not specified (likely minimal or informal)
Common Issues	Power fluctuations, lack of skilled manpower, low farmer awareness, maintenance gaps
Upgrades Needed	Generator backup, capacity-building/training programs, storage expansion
Future Demand	High and growing demand for cold storage in the area
User Feedback	Siddhartha: Better post-storage quality, modest revenue, but operational challenges remain; Khagada: Higher spoilage, informal use, more support needed

4.1.3 PMAMP, PIU, Illam

1. **Cold Room Owner : Ganga Bahadur Bista**

   Ganga Bahadur Bist's cold room in Sakhejung, Ilam, Koshi Province, has a 6-ton capacity and two chambers, mainly storing kiwi and potatoes for up to 5 months at 0–4°C. The facility runs 24 hours a day, year-round, with about 67% utilization and uses both grid and generator power. Built at a total cost of NPR 6.67 lakh (with PMAMP subsidy), it generates NPR 25,000 monthly revenue and maintains excellent quality with a spoilage rate of just 0.05%. The main challenges faced are quick ripening of produce and electricity problems.

   There are no formal training programs for staff, but regular electricity helps reduce losses, and waste is managed through manure composting. Demand for cold storage is at its peak and expected to remain high for the next five years. The owner plans to expand and upgrade the facility, including adopting new technologies. While user feedback is good and profit margins are healthy, the owner emphasizes the need for more research, high-tech solutions, and better training to maximize cold storage effectiveness in Nepal.

2. **Cold Room Owner : Rudraprasad Katiwada**

   Rudraprasad Katiwada operates a 6-ton cold room in Ilam, Koshi Province, primarily used for storing kiwi for up to one month at 4°C. The facility, built five years ago with a total setup cost of NPR 7 lakh (including NPR 2 lakh user investment and PMAMP subsidy), runs on grid electricity and maintains temperature and humidity monitoring, though it lacks alarm systems. The cold room operates 24 hours a day during the storage season (mainly Poush), with annual maintenance and about 14 kWh daily energy use.

   Utilization is currently low (10%), and no revenue or profit is generated, as the facility is not rented out. Major challenges include quick ripening of kiwis and electricity issues. No formal training is provided to staff, and waste is managed through composting. Spoilage rates are very low (0.1%) due to high-quality materials and regular electricity. Demand for cold storage is at its peak and expected to remain high, with Indian farmers as key competitors. Plans are in place for facility upgrades and adoption of new technologies, but the owner emphasizes the need for training facilities and further research to improve effectiveness.

Table 4.3 Combined Summary of Technical Report from Illam District

Aspect	Observations
Common Products Stored	Kiwi and potatoes
Typical Storage Capacity	6 metric tons each (both facilities)
Utilization Range	Ganga Bahadur Bista: ~67%; Rudraprasad Katiwada: ~10%

Aspect	Observations
Operating Hours	Both operate 24 hours daily during storage season; Ganga Bahadur year-round, Rudraprasad seasonal (Poush)
Storage Duration	Ganga Bahadur Bista: up to 5 months; Rudraprasad Katiwada: up to 1 month
Temperature Range	Maintained between 0–4°C
Spoilage Rate	Very low spoilage: 0.05% (Ganga Bahadur), 0.1% (Rudraprasad)
Revenue Model	Ganga Bahadur Bista: NPR 25,000 monthly revenue; Rudraprasad Katiwada: no revenue (not rented)
Power Supply	Ganga Bahadur: grid electricity with generator backup; Rudraprasad: grid electricity only
Maintenance & Training	Annual maintenance for both; no formal training programs
Waste Management	Waste managed through composting
Common Issues	Quick ripening of produce and electricity supply problems
Upgrades Needed	Facility upgrades, new technologies, improved training, and research
Future Demand	High current demand, expected to remain high
User Feedback	Positive feedback, good profits, highlights need for research and technical solutions



Fig 4.4 Highlights of survey at Illam district

4.1.4 PMAMP, PIU, Ramechhap

1. Cold Room Owner : Dhan Bahadur Tamang

Dhan Bahadur Tamang operates a 5-ton citrus cold storage facility in Ramechhap, Bagmati, running 24 hours a day during a four-month season. The facility maintains 5–8°C and uses about 250 units of electricity daily, with a generator for backup during loadshedding. Initial setup cost was NPR 1,020,000, with government subsidies and a user investment of NPR 270,000. Monthly revenue during the season is NPR 108,000, with a 20% profit margin. Spoilage rates are 5–10%, mainly due to water loss and occasional fungus, which is managed with pesticides. Demand is currently at maximum and expected to double in five years, with no local competitors. Key challenges include a lack of skilled technicians and no staff training, highlighting the need for regular maintenance and training programs. Overall, user feedback is positive, and upgrades with new technologies are planned.

2. **Cold Room Owner : Padam Bahadur Lama**

Padam Bahadur Lama's cold storage facility in Ramechhap, Bagmati, has a 5-ton capacity and stores sweet oranges for up to three months at 5°C, with both temperature and humidity monitoring. Operating year-round, it uses grid electricity, consuming 22 units daily, with monthly energy and maintenance costs of NPR 7,500 and NPR 10,000, respectively. The initial setup cost was 14 lakhs NPR, with government subsidies and a personal investment of 4 lakhs NPR. Monthly revenue averages NPR 105,000, yielding a 20% profit margin. Spoilage is minimal (0.04%) due to careful harvesting and handling. The main challenges are loadshedding, transportation costs, and limited market demand. There are no local competitors, and demand is expected to double in five years. While staff training is lacking, upgrades and new technologies are planned. Suggestions include providing training, improving transportation, and offering electricity discounts to enhance effectiveness.

3. **Cold Room Owner : Hari Bahadur Tamang**

Hari Bahadur Tamang operates a 6-ton sweet orange cold storage facility in Ramechhap, Bagmati, running for 10 months a year (excluding Baishakh and Jestha) at 6–9°C with both temperature and humidity monitoring. The facility uses grid electricity, consuming 13 units daily (15 at peak), and rarely requires maintenance. Initial setup cost was NPR 1.2 million, with the cold room and shed costing NPR 750,000 and NPR 100,000, respectively. Monthly operating, maintenance, and energy costs are NPR 6,000, 2,000, and 4,000, while monthly revenue reaches NPR 133,000, with a 40% profit margin. Spoilage is very low at 0.08%, and quality remains similar before and after storage. The main challenge is loadshedding, addressed by backup provision. Waste is composted, and user feedback is positive. Demand is high and expected to double in five years, with plans for upgrades and new technologies. Regular inspections and staff training are recommended for further improvement.

4. **Cold Room Owner : Rajesh Basnet**

Rajesh Basnet manages a 12-ton cold storage facility in Boch, Dolakha, Bagmati, operating two chambers for storing fruits (mainly kiwi) and vegetables. The facility runs year-round, maintaining a temperature of 1–5°C with humidity monitoring, but lacks alarm systems for deviations. It operates 24 hours daily, with grid electricity as the primary energy source, though exact energy consumption figures are not available. The initial setup cost was NPR 1.8 million, including NPR 1.5 million for the cold room and NPR 200,000 for the shed, with government subsidies and a user investment of NPR 900,000. Monthly revenue is NPR

600,000, but profit margins are currently zero due to high operating and maintenance costs. Spoilage rates are low at 0.5%, with only minor changes in product quality after storage. The main challenge is a lack of regular maintenance. Staff training is provided by PMAMP PMU Khumaltar, and upgrades with new technologies are planned.

Table 4.4 Combined Summary of Technical Report from Ramechhap District

Aspect	Observation
Common Products Stored	Citrus fruits (oranges), kiwi, and vegetables
Typical Storage Capacity	5 to 12 tons, often with multiple chambers
Utilization Range	Year-round or seasonal operation (4–10 months), mostly 24 hours/day during active periods
Operating Hours	Mostly 24 hours/day during operation
Storage Duration	Typically 90 days (up to 3 months) depending on product
Temperature Range	Maintained between 1°C and 9°C with temperature and humidity monitoring
Spoilage Rate	Generally low (0.04% to 10%), improved by better handling and pest control
Revenue Model	Monthly revenues range NPR 105,000 to 600,000; profit margins 0% to 40%
Power Supply	Mainly grid electricity with generator backup to handle loadshedding
Maintenance & Training	Maintenance varies; common lack of skilled technicians and staff training
Waste Management	Some compost waste; others unspecified
Common Issues	Loadshedding, high transport and operating costs, technician shortages
Upgrades Needed	Plans for IoT, automation, and new technology adoption
Future Demand	Currently high or maxed out; expected to double in five years
User Feedback	Generally positive across all facilities

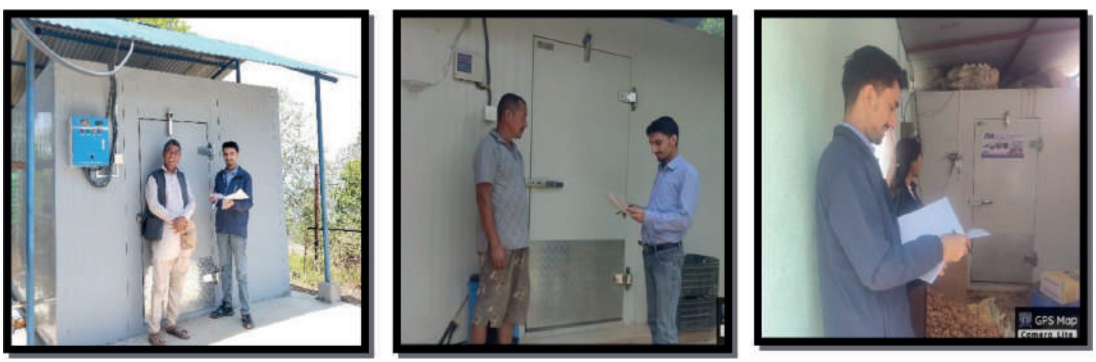


Fig 4.5 Highlights of survey at Ramechhap district

4.1.5 PMAMP, PIU, Kapilbastu

1. **Cold Room Owner : Krishna Mohan Kewat**

   Krishna Mohan Kewat operates a 5-ton cold storage facility in Buddhabhumi Municipality, Kapilvastu, Lumbini Province, primarily for his own use. The facility stores a variety of products including tomato, cabbage, cucumber, watermelon, mango, and yam, with shelf life maintained at 10°C for leafy vegetables and 4°C for long-term storage. It operates 24 hours a day for six months annually, with a current utilization rate of 60%. The facility is equipped with temperature and humidity monitoring systems and alarm systems for deviations. Average daily energy consumption is 50 kWh, peaking at 150 kWh, and monthly operating costs are NPR 20,000. The average spoilage rate is 15%, mainly due to multi-commodity storage issues, which are addressed using racks and crates. Waste is disposed of by dumping. Staff training has been provided, and the facility has received government subsidies. There are no plans for expansion, but adoption of new technologies is underway. User feedback is positive.

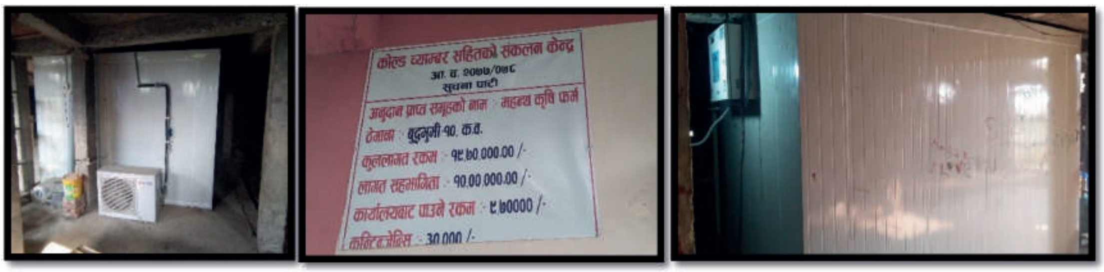


Fig 4.6 Highlights of survey at Kapilbastu district

4.1.6 PMAMP, PIU, Sindhuli

1. **Cold Room Owner : Santa Bahadur Sinjali**

   Santa Bahadur Sinjali operates a 6-ton sweet orange cold storage facility in Golanjor-04, Tinkanya, Sindhuli. The facility has one chamber, runs year-round with 24-hour operation, and maintains a temperature of 6°C. Both temperature and humidity are monitored, and alarm systems are present. The initial setup cost was NPR 730,000, with government subsidies received. The average monthly operating cost is NPR 15,000, plus NPR 7,000 for maintenance and NPR 4,500 for energy, generating monthly revenue of NPR 25,000. Spoilage rates are low at 0.25%, and waste is managed through composting or used as livestock feed. The facility faces challenges such as irregular electricity, system disconnects, lack of skilled technicians, and transportation issues. Staff training is provided by PMAMP Sindhuli. Demand for cold storage is high and expected to grow, with plans for upgrades and adoption of new technologies. User feedback is positive, but increased subsidies and more training are recommended.

2. **Cold Room Owner : Santa Bahadur Sinjali**

Lok Bahadur Aale operates a 6-ton cold storage facility in Golanjor-4, Tinkanya, Sindhuli, primarily storing sweet oranges for up to 90 days at 6°C. The facility has one chamber and operates 24 hours daily, with both temperature and humidity monitoring, though it lacks an alarm system for deviations. Annual maintenance is performed, and the average daily energy consumption is 0.019 kWh, peaking at 0.58 kWh. The initial setup cost was NPR 700,000, with government subsidies and a user investment of NPR 350,000. Monthly revenue is NPR 40,000, with operating, maintenance, and energy costs totaling about NPR 27,000. Spoilage rates are very low at 0.05%, thanks to proper temperature and humidity management. Common challenges include blue mold and irregular electricity supply, addressed through technical knowledge and treatment. Waste is managed by composting and dumping. User feedback is excellent, and upgrades, including new technologies, are planned. Continuous electricity supply and further training are recommended.

3. **Cold Room Owner : Indra Bahadur Purbachhane Magar**

Indra Bahadur Purbachhane Magar operates a 6-ton cold storage facility in Golanjor-04, Tinkanya, Sindhuli, primarily storing sweet oranges and mandarin for 60 days at 5-8°C. The facility, built in 2080/81, runs 24 hours daily and rarely requires maintenance. It uses electricity, consuming 0.130 kWh daily (0.19 kWh peak), and monitors both temperature and humidity, though it lacks an alarm system. The initial setup cost NPR 700,000, with a cold room cost of NPR 534,602 and a shed cost of NPR 165,398. The owner received government subsidies and invested NPR 442,000. Average monthly operating costs are NPR 10,000, with maintenance and energy costs at NPR 3,000 each, generating NPR 30,000 in monthly revenue. Spoilage is very low at 0.01%, and the quality of goods remains good after storage. Key issues include electricity fluctuations, but staff training is provided by PMAMP, Sindhuli. Waste is managed by dumping. Upgrades and adoption of new technologies are planned, and there is a stated need for more training to improve effectiveness. User feedback is excellent, but there is no current or projected demand.

4. **Cold Room Owner : Hari Babu Gajurel**

Hari Babu Gajurel operates a 6-ton cold storage facility in Golanjor-05, Khaniyakharka, Sindhuli, mainly storing sweet oranges for up to two months at a maintained temperature of 4–7°C. The facility runs 24 hours daily with both temperature and humidity monitoring, though it lacks an alarm system for deviations. Utilization is currently low at 0.5%, and the average spoilage rate is just 0.06%, thanks to proper environmental control. The initial setup cost was NPR 600,000, with government subsidies and a user investment of NPR 300,000. Monthly revenue is NPR 35,000, with profit margins and operating costs detailed, and waste is managed through composting. Common issues include problems with the humidifier and electricity fluctuations, and the facility rarely requires maintenance. Staff training is provided by PMAMP Sindhuli. User feedback is excellent, but challenges remain due to a lack of skilled technicians and high repair costs. Upgrades and adoption of new technologies are planned, with projected demand expected to rise in the next five years.

5. **Cold Room Owner : Dil Kumari Thapa Magar**

Dil Kumari Thapa Magar operates a 6MT cold storage facility in Golanjor-05, Sindhuli, primarily storing oranges and mandarin oranges with a shelf life of three months. The facility uses only electricity, maintaining temperatures of 6-8°C, and operates 24 hours daily. Average monthly maintenance costs are NPR 20,000, with energy costs at NPR 3,100, and monthly revenues of NPR 30,000. The cold storage faces issues with the humidifier and a lack of skilled technicians, resulting in higher maintenance costs. Spoilage is minimal (0.6%), and spoiled produce is repurposed for alcohol production. The facility has received government subsidies and plans for upgrades and new technologies, but staff training is lacking. Waste is managed through composting and dumping. Competition exists locally, and while current demand is low, growth is projected over the next five years. User feedback is positive, but technical challenges persist.

Table 4.5 Combined Summary of Technical Report from Sindhuli District

Aspect	Observation
Common Products Stored	Oranges, kiwis, apples
Typical Storage Capacity	Mostly 10 tons; one facility at 20 tons
Utilization Range	Moderate to high utilization; specific data limited
Operating Hours	Continuous 24-hour operation year-round
Storage Duration	1–3 months for citrus and kiwis; 5–7 months for apples
Temperature Range	Maintained between 2°C and 8°C depending on product
Spoilage Rate	High spoilage (20–25%) for citrus due to early ripening; low (1–2%) for apples
Revenue Model	Monthly revenue ranges NPR 20,000–50,000; profits vary
Power Supply	Primarily grid electricity; occasional generator backup
Maintenance & Training	Annual maintenance common; lack of staff training and loss control measures
Common Issues	Early fruit ripening, transportation challenges, high operating costs, limited alarms
Upgrades Needed	Planned tech upgrades, better humidifiers, energy efficiency improvements
Future Demand	Very high demand across all facilities
User Feedback	Generally positive; technical and training gaps remain

Fig 4.7 Highlights of survey at Sindhuli district

4.1.7 PMAMP, PIU, Chitwan

1. Cold Room Owner : Gupta Bahadur Regmi

Gupta Bahadur Regmi operates a 10MT cold storage facility in Nawalparasi East, Nuwalpur, primarily storing lemons with a shelf life of three months. The facility has two chambers, maintains a temperature range of 0-8°C, and operates about four hours daily, consuming roughly 20 kWh of energy per day. Maintenance is rarely required, and the system monitors temperature, humidity, and CO2, with alarms for deviations. The setup cost was 11 lakhs, with an average monthly operating cost of 8,000 and monthly energy costs of 4,000. Over three months, the facility generates 200,000 in revenue and 85,000 in profit. The main challenges include electricity fluctuations and limited knowledge about temperature and RH control. Staff receive PMAMP-provided training, and user feedback is excellent. The spoilage rate is low (0.03%), and demand for cold storage is rising, with projected growth in the next five years. Upgrades and new technologies are being considered

Fig 4.8 Survey at Nawalparasi East district

4.1.8 PMAMP, PIU, Mustang

1. **Cold Room Owner : New Annapurna Krishi Tatha Pasu Multi Agro Farm**

   New Annapurna Krishi Tatha Pasu Multi Agro Farm operates a 10-ton cold storage facility in Narchang, Myagdi, Gandaki Province, storing oranges, kiwis, and apples for 1-3 months. The facility maintains a temperature range of 8°C, 2°C, and 2-3°C, operates 24 hours daily, and uses grid electricity. Maintenance is performed annually, and temperature monitoring with alarms is in place. The initial setup cost was 17 lakh, with a shed costing 4 lakh and average monthly operating and energy costs of 4,000 each. The facility was constructed in 2078 and received government subsidies. Quality decreases after storage, especially with early ripening of oranges and kiwis, leading to a 20% spoilage rate in oranges. Improved humidifiers have been used as a solution, but no loss reduction measures or staff training have been implemented. User feedback is good, demand is very high, and upgrades and new technologies are planned, though transportation remains a key challenge

2. **Cold Room Owner : Rakal Enterprises Pvt. Ltd.**

   Rakal Enterprises Pvt. Ltd. operates a 10-ton cold storage facility in Beni, Myagdi, Gandaki Province, primarily storing oranges for 1-2 months at 8°C. The facility has two chambers, runs 24 hours daily on grid electricity, and undergoes annual maintenance. Temperature is monitored, but there are no alarm systems for deviations. The initial setup cost was 17.5 lakh, with 13 lakh for the cold room and 4.5 lakh for the shed, and it was constructed in 2080 with government subsidies. Average monthly operating and energy costs are 5,000 each, while annual maintenance costs are 7,000. The facility faces a high spoilage rate (20-25%) due to early ripening of oranges and has not implemented loss reduction measures or staff training. Transportation from the field to the cold chamber is a significant challenge. Despite these issues, user feedback is good, demand is very high, and there are plans for upgrades and new technologies, though further research is recommended.

3. **Cold Room Owner : Highland Agro Farm**

   Highland Agro Farm in Marfa, Mustang, operates a 10-ton cold storage facility with two chambers, primarily storing apples for 5–6 months at 2–3°C. The facility runs 24 hours daily on grid electricity, with annual maintenance and temperature monitoring but lacks alarm systems for deviations. The initial setup cost was 17 lakh, plus 4 lakh for the shed, and average monthly operating, maintenance, and energy costs are each 3,000. Built in 2079 with government subsidies and 4.5 lakh user investment, the facility generates 20,000 monthly revenue. The main challenge is weight loss of apples and a slight decrease in taste and weight after storage, with spoilage rates of 1–2%. Good humidifiers are used, but no specific loss reduction measures or staff training programs have been implemented. User feedback is excellent, demand is very high, and upgrades and adoption of new technologies are planned, with a need for lower energy costs and improved transportation.

4. **Cold Room Owner : Dhamang Krishak Samuha**

Dhamang Krishak Samuha operates a 20-ton cold storage facility in Gharapjhong-02, Marfa, Mustang, mainly storing apples for 6–7 months at 2–3°C. The facility has two chambers, runs 24 hours daily on grid and generator power, and is monitored for temperature and humidity, with alarms for deviations. Annual maintenance is required, but high operating costs and timely machine maintenance are significant challenges. The setup cost was 30 lakh (18 lakh for the cold room, 12 lakh for the shed), with monthly operating, maintenance, and energy costs totaling 21,000. Built in 2078 with government subsidies and 12 lakh user investment, it generates 50,000 monthly revenue and 20,000 profit. Spoilage rates are low (1–2%), though apples experience slight taste and weight loss. New humidifier technology is used, but no specific loss reduction measures or staff training exist. User feedback is excellent, demand is very high, and upgrades and new technologies are planned, though skilled manpower and transportation remain concerns.

Table 4.6 Combined Summary of Technical Report from Mustang District

Aspect	Observation
Common Products Stored	Oranges, kiwis, apples
Typical Storage Capacity	10 tons (except Dhamang Krishak Samuha with 20 tons)
Utilization Range	Not explicitly stated; implied moderate to high utilization
Operating Hours	24 hours daily, year-round operation
Storage Duration	1–3 months for oranges and kiwis; 5–7 months for apples
Temperature Range	2°C to 8°C depending on product and facility
Spoilage Rate	High spoilage for oranges (20–25%) due to early ripening; low spoilage for apples (1–2%)
Revenue Model	Monthly revenue ranges from NPR 20,000 to NPR 50,000; profits reported at Dhamang Krishak Samuha (NPR 20,000/month)
Power Supply	Grid electricity common; one facility uses grid plus generator
Maintenance & Training	Annual maintenance common; lack of staff training and loss reduction measures in all facilities
Common Issues	Early ripening causing spoilage, transportation challenges, high operating costs, lack of alarm systems in some
Upgrades Needed	All plan upgrades and adoption of new technologies, including humidifiers and energy efficiency
Future Demand	Very high demand across all facilities
User Feedback	Generally good to excellent

Fig 4.9 Highlights of survey at Mustang district

4.1.9 PMAMP, PIU, Rupandehi

1. Cold Room Owner : Shree Jaldevi Matsya Utpaadan Sahakari Sanstha Limited

Shree Jaldevi Matsya Utpaadan Sahakari Sanstha Limited operates a fish cold storage facility in Siyar-5, Bangsari, Rupandehi, Lumbini Province, with a total capacity of 10MT plus a 500 kg/batch blast frozen unit. The facility has three chambers and maintains temperatures of -32°C (blast chamber) and 10–20°C (storage chamber), with an 8-hour daily operation and quarterly maintenance. Energy consumption averages 18.6 kWh daily, peaking at 20 kWh, using both grid and generator power. Alarm systems monitor temperature deviations. Despite a low utilization rate (0.1%) and no current revenue, the spoilage rate is minimal (0.1%) due to strict grading and processing. The main challenges include lack of technical personnel, limited market size, and low public awareness. Waste is managed by dumping or feeding pigs. The facility received government subsidies, and user feedback is positive. Demand is currently low but expected to rise, with future improvements suggested, such as mechanized processing and fish dryers.

Fig 4.10 Highlights of survey at Rupandehi district

4.2 Products Stored in Cold Rooms

The most commonly stored items are fruits, particularly citrus varieties such as sweet orange and mandarin, which appear most frequently across facilities. Apples and kiwis are also popular, with several cold rooms dedicated specifically to their storage. In addition to fruits, some facilities store vegetables including tomato, cabbage, cucumber, watermelon, mango, yam, and potatoes highlighting the role of cold storage in preserving both fruit and vegetable crops.

Other notable products include lemon and fish, indicating that some cold rooms are used for non-plant-based perishables. A few facilities also mention storing seeds and vegetable seedlings, reflecting the use of cold storage for agricultural inputs as well as harvested produceOverall, citrus fruits (sweet orange, mandarin), apples, and kiwis dominate cold storage usage, followed by a variety of vegetables and occasional storage of fish and seeds. This diversity underscores the importance of cold storage in supporting both horticultural and agricultural value chains.

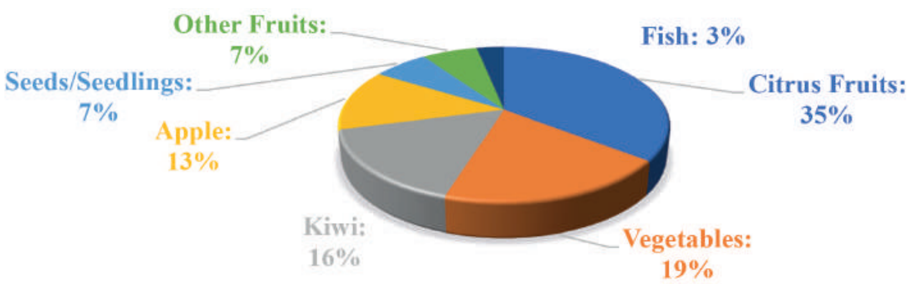


Fig 4.11 Products Store in Cold Rooms

4.3 Current Utilization Rate

The survey of cold room utilization rates reveals a diverse range of usage levels, from completely unused (0%) to fully utilized (100%). Notably, a significant number of cold rooms seven in total are operating at full capacity, demonstrating strong demand and effective use. Additionally, several cold rooms show high utilization rates between 80% and 85%, while others maintain moderate usage levels ranging from 50% to 70%. However, some cold rooms are underutilized, with rates as low as 10% and 30%, and a few are not in use at all. One cold room remains non-functional due to the absence of an adopted business model, highlighting a critical operational challenge. Overall, while the majority of cold rooms are efficiently utilized, the variation in usage suggests opportunities for improving management practices and business strategies to enhance the performance of underutilized or inactive facilities. Addressing these gaps could optimize capacity and increase overall efficiency in cold storage operations.

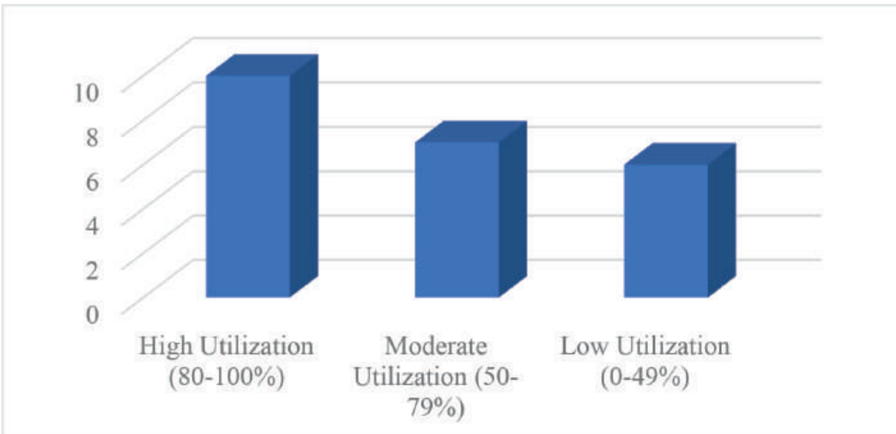


Fig 4.12 Utilization rate of Cold Room

4.4 Temperature Ranges and Operational Hours

The analysis of temperature ranges and average operational hours in various cold storage facilities reveals a predominant trend of maintaining temperatures between 2°C to 8°C, with most units operating continuously for 24 hours. Facilities storing green leafy vegetables and long-term storage items reported specific temperature settings of 10°C and 4°C, respectively, during peak seasons. A few facilities experienced operational constraints, such as reduced hours (4-8 hours) due to electricity fluctuations or product load. Blast chambers were maintained at -32°C for rapid cooling, while storage chambers operated at higher temperatures (10°C and 20°C) for limited hours. Some units were not in operation during the survey period. Overall, the data highlights the critical importance of consistent temperature maintenance for optimal storage, with operational hours largely dictated by product requirements and infrastructure reliability. Seasonal variations and electricity supply issues were notable factors affecting operational consistency in certain facilities.

4.5 Cold Room Maintenance Frequency

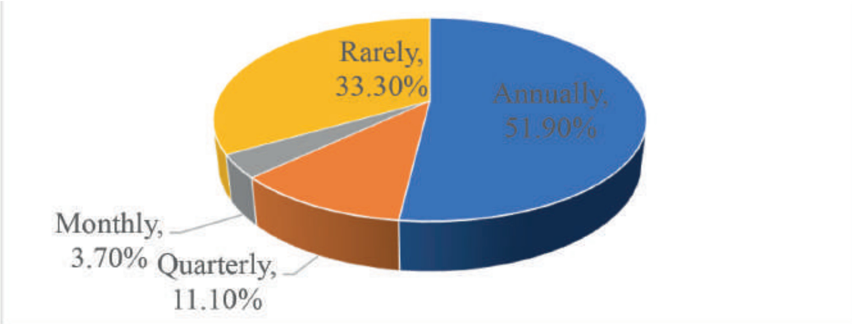


Fig 4.13 Cold Room Maintenance Frequency

The maintenance frequency of cold rooms shows that over half (51.9%) of the facilities undergo maintenance annually, indicating a common practice of yearly upkeep. About one-third (33.3%) reported maintenance is required rarely, suggesting durable equipment or infrequent use. Quarterly maintenance is needed in 11.1% of cases, reflecting facilities with higher operational demands or older systems. Only a small fraction (3.7%) require monthly maintenance, likely due to intensive usage or specific operational needs. Overall, the data highlights that annual maintenance is the norm, with occasional variations depending on equipment condition and usage intensity, emphasizing the importance of regular servicing to ensure cold room efficiency and reliability.

4.6 Energy Consumption and Primary Energy Sources

The study of energy consumption in cold storage facilities reveals a wide range of average daily and peak energy usage, reflecting diverse operational scales and equipment efficiency. Most facilities primarily rely on grid electricity as their main energy source, with some supplementing it with generators. Average daily energy consumption varies significantly, from as low as 0.0012 kWh to over 500 kWh, while peak consumption also shows considerable variation, sometimes exceeding average values by a large margin. Several facilities reported very low energy use, indicating small-scale operations or efficient systems, whereas others recorded extremely high consumption, likely due to larger capacity or older, less efficient equipment. A few units were not in operation or lacked access to three-phase power supply. The data underscores the importance of energy management and potential for optimization in cold storage operations, highlighting opportunities to reduce costs and environmental impact through improved energy efficiency and alternative energy sources.

4.7 Monitoring and Alarm Systems

The assessment of monitoring systems in cold storage facilities shows that temperature monitoring is the most common system installed, often accompanied by humidity sensors. However, many facilities lack comprehensive monitoring, with some having no separate or additional systems beyond initial installation. Alarm systems for deviations are generally absent, with only a few facilities equipped with alarms to alert for irregularities in temperature, humidity, or CO_2 concentration. Overall, while temperature and humidity monitoring are somewhat prevalent, the presence of alarm systems remains limited, indicating a potential risk for unnoticed deviations that could affect product quality. Enhancing alarm integration alongside monitoring systems would improve operational reliability and product safety.

4.8 Modes of Storage and Delivery Transportation

The data on storage and delivery methods in cold chain operations reveals a mix of human labor and various vehicle types. For storage handling, human agency and manual labor dominate, with some use of cool booths and light trucks. Delivery methods primarily rely on trucks, including refrigerated trucks, boleros, jeeps, pickups, and tractors, reflecting diverse transport needs based on product type and distance. Smaller vehicles like mini trucks, personal vehicles, and public buses are occasionally used, especially for local deliveries. The combination of human effort and mechanized transport highlights the flexible, often resource-constrained nature of cold chain logistics, emphasizing the importance of appropriate vehicle selection to maintain product quality during transit and storage.

4.9 Summary of Initial Setup, Cold Room, and Shed Costs

The cost analysis of cold storage facilities shows a wide range of initial setup expenses, with cold room costs generally constituting the largest portion. Initial setup costs vary from approximately 5 lakhs to over 30 lakhs, reflecting differences in facility size, technology, and location. Cold room construction costs closely align with initial setup expenses, typically ranging between 5 lakhs and 18 lakhs. Shed costs, when applicable, are significantly lower, mostly between 10,000 and 4.5 lakhs, with some facilities reporting no shed costs at all. The variability in shed costs depends on materials used, such as CGI sheets, and the scale of the structure. Overall, the data highlights that cold room investment is the major financial component, while shed costs are relatively minor but necessary for protection and operational efficiency. This cost breakdown aids stakeholders in budgeting and planning cold storage infrastructure development.

4.10 Operating Months, Costs, Revenue, and Profit Margins

The data on cold storage operations reveals diverse operating months, cost structures, and profitability across facilities. Operating periods range from 2 months to year-round, often aligned with seasonal crop cycles. Average monthly operating costs vary widely, from as low as Rs 1,000 to over Rs 20,000, with maintenance costs frequently unreported or inconsistent. Energy costs typically range between Rs 1,600 and Rs 7,500 monthly. Monthly revenue generation fluctuates significantly, from negligible amounts to over Rs 2 lakh, with profit margins reported between 0% and 60%, depending on operational efficiency and scale. Some facilities operate primarily for own use with no profit, while others show healthy margins around 30-50%. Several units have yet to estimate profit margins or document costs fully. Overall, the data highlights the variability in cold storage economics, influenced by seasonality, scale, and management practices, underscoring the need for better cost tracking and financial planning.

4.11 Quality Issues, Common Problems, and Manufacturer Responses

The evaluation of product quality before and after cold storage reveals several recurring issues such as weight loss, early ripening, spoilage, and softening of fruits like kiwi, orange, and apple. Common problems include temperature fluctuations, electricity load shedding, irregular maintenance, and equipment malfunctions, particularly with humidifiers and air conditioning systems. Solutions suggested range from improved post-harvest handling, consistent temperature and humidity control, backup generators, to technical training and better maintenance practices. Manufacturer responses vary widely from good and timely support to poor or no response, with some manufacturers not responding to calls or providing delayed services. Facilities with proper maintenance and technical knowledge report better quality retention. Overall, the findings highlight the critical role of stable cold storage conditions and responsive technical support in preserving product quality and minimizing losses.

4.12 Key Issues and Challenges Faced by Cold Storage Users

Cold storage users face multiple challenges impacting the efficiency and effectiveness of their operations. A common issue is inadequate storage capacity, with cold booths and chambers often too small relative to production volumes, especially during peak harvest seasons. Frequent electricity fluctuations and load shedding, coupled with the absence of alternative power sources like generators, disrupt continuous operation. Maintenance difficulties arise due to poor manufacturer response, lack of skilled technicians, and irregular servicing. Additional problems include periodic AC failures, gas leaks, and malfunctioning humidifiers. Transportation logistics and limited market demand further complicate storage utilization. High operating costs and technical complexity add to user burdens, while low public awareness and market competition limit profitability. Overall, these challenges highlight the need for improved infrastructure, reliable power supply, skilled manpower, and better technical support to enhance cold storage performance and user satisfaction.

4.13 Suggestions for Enhancing Cold Storage Effectiveness and User Support

Users emphasize the urgent need for larger cold chambers instead of small cool booths to accommodate higher production volumes. Adequate and continuous training on cold room operation, maintenance, and product handling is critical to improve efficiency and reduce technical issues. Many suggest better guidance from manufacturers and local authorities, along with regular monitoring by technicians. Reliable electricity supply and backup generators are essential to ensure uninterrupted operation. Improving infrastructure through budget allocation for high-capacity storage, quality assurance by responsible companies, and availability of local repair dealers is also recommended. Users call for enhanced transportation facilities to reduce post-harvest losses and better crate or rack systems for handling. Additionally, research on crop-specific storage, subsidized energy costs, and shifting towards mechanized processing are suggested to boost cold storage effectiveness and reduce product wastage. Overall, training, infrastructure, and technical support form the cornerstone for improving cold storage operations.

4.14 FGD – Ramechhap District, Ramechhap Municipality

The Focus Group Discussion (FGD) conducted in Sindhuli district, Ramechhap Municipality, involved key stakeholders including the municipality head, officials, PIU Sindhuli office team, PMU engineering team, farmers, and entrepreneurs. The discussion highlighted several critical issues and recommendations for improving citrus cold storage and overall agricultural productivity. Participants emphasized the need for long-term expert planning and reliable electricity supply to enhance cold room utilization, which currently operates only about 120 days annually. Market facilities require improvement, along with better technology dissemination and affordable, discounted transportation for farmers. The mayor stressed the importance of infrastructure development aligned with production capacity, irrigation support, and increased budget allocation. Positive feedback was given for the PIU Ramechhap team's efforts, with suggestions to upgrade Junar zone to a Superzone and promote local farmers. Ward heads raised concerns about insect control, government procurement of farmers' produce, and the need for better monitoring and grievance management. Cold chain management training was identified as essential for sustainable development.

Fig 4.14 Highlights of FGD and Field Monitoring at Ramechhap District

4.15 FGD– PMAMP Dolakha

In Dolakha, large-scale kiwi farmers, officials from the Dolakha team, and the PMU engineering team discussed challenges and opportunities related to kiwi production and storage. Market fluctuations were identified as a significant issue, causing some farmers to sell their kiwi prematurely, which affects quality and profit. The primary market for kiwi remains Kathmandu. Despite these challenges, farmers expressed general satisfaction with the cold room facilities and demonstrated good knowledge of maintenance procedures. Electricity supply and transportation were noted as minor issues but did not significantly hinder operations. The discussion emphasized the importance of market stabilization and continued support for cold storage infrastructure to help farmers maximize the quality and value of their kiwi produce.

Fig 4.15 Highlights of FGD and Field Monitoring at Dolakha District

4.16 FGD– PMAMP Rautahat

The Focus Group Discussion (FGD) in Garuda Municipality, Rautahat district, included the mayor, ward chiefs, PMAMP PIU Rautahat, and PMU engineering teams, along with cold room users primarily engaged in vegetable and banana farming. The mayor highlighted the need for a large cold storage facility, improved irrigation, and cold storage for meat and fish. The ward chief emphasized the importance of monitoring and raised concerns about subsidy duplication. Cold room users noted challenges from the open border with India, which disrupts Nepal's market and limits cold room utilization. The PMU senior agricultural engineer advised conducting a feasibility study before building a large-scale cold room. Following the discussion, the PIU and PMU teams visited existing cold rooms to gain practical insights from farmers. This FGD showcased a collaborative effort to evaluate the cold room's impact and effectiveness, addressing local needs and obstacles to optimize cold storage use and enhance agricultural market access under the PMAMP initiative

Fig 4.16 Highlights of FGD and Field Monitoring at Rautahat District

4.17 FGD– PMAMP Sindhuli

The Focus Group Discussion with the PIU Sindhuli team, Golanjar Rural Municipality agriculture officers, PMU engineering team, and PIU Sindhuli intern highlighted the cold rooms in Sindhuli, a key Superzone under PMAMP with multiple facilities constructed. Primarily, these cold rooms store Junar, followed by other products such as potatoes, kiwis, and apples. The cold rooms operate continuously throughout the year, maintaining temperatures suitable for different fruits. While utilization is generally moderate to high, farmers reported challenges including high spoilage rates for certain fruits due to early ripening, transportation difficulties, and high operating costs. Power supply is mostly from the grid with occasional generator backup, and annual maintenance is common; however, there is a lack of adequate staff training and loss control measures. Users expressed generally positive feedback but noted gaps in technical support and training. Planned upgrades aim to improve technology, humidification, and energy efficiency. Overall, there is very high demand for cold storage facilities in the region, reflecting their critical role in supporting local agriculture and reducing post-harvest losses.

Fig 4.17 Highlights of FGD and Field Monitoring at Sindhuli District

4.18 FGD– Engineering Team & Entrepreneurs

The Focus Group Discussion (FGD) involved agricultural engineers from PMAMP, cold room users from various districts of Nepal, and students from the Faculty of Agriculture at IOE Purwanchal Campus, following a training session conducted by the PMU team. The training facilitated knowledge exchange among agricultural engineers, officers, students, and entrepreneurs on Cold Chain Management. It enhanced technical understanding of effective cold room operation and management, introduced essential components and their uses, and helped identify and solve common operational challenges. The session also promoted the establishment of a network among cold room operators to share experiences and best practices, emphasizing the use of advanced cold chain technologies for improved efficiency.

Participants suggested several improvements, including developing basic infrastructure such as pre-cooling chambers, reliable electricity supply, and proper harvesting tools before storage. They stressed the importance of improved coordination between cold room operators and technical staff to ensure smooth operations. Additionally, adopting digital monitoring systems to control temperature and humidity with the latest technology was recommended to enhance cold room performance and reduce post-harvest losses. Overall, the training significantly built capacity and fostered collaboration among stakeholders to optimize cold chain management in Nepal.

Fig 4.18 Highlights of FGD and Field Monitoring

4.19 Case Study: Economic Viability of Cold Room Storage for Junar in Ramechhap

This case study highlights the economic potential of cold room/cold chamber storage in enhancing profitability for fruit farmers, using a real-life example from a farmer's field in the Junar Zone under the PMAMP-PIU Ramechhap.

Overview

- **Location:** Junar Superzone, PMAMP-PIU Ramechhap
- **Commodity:** Junar (Sweet Orange)
- **Cold Room Capacity:** 5 Metric Tons (Mton)

To assess the benefit of cold storage, a sample storage of 105 crates of Junar (each with a 20 kg capacity) was conducted, totaling 2.1 Mton (21 quintals) of fruit stored.

Economic Analysis

- **Harvest Season (Poush) Price:** NPR 55/kg
- **Gross Income at Harvest:** 2,100 kg × NPR 55 = NPR 115,500
- **Post-Storage Price (Baisakh):** NPR 160/kg
- **Effective Sale Quantity (after 10% loss):** 1,890 kg
- **Gross Income Post-Storage:** 1,890 kg × NPR 160 = NPR 302,400
- **Profit from Price Increase:** NPR 302,400 – NPR 115,500 = NPR 186,900
- **Operational Cost (3 months):** NPR 30,000
- **Net Profit:** NPR 156,900

The findings clearly demonstrate that storing 2.1 Mton of Junar for three months results in a net profit of NPR 156,900, even after accounting for a 10% storage loss and operational costs. If the farmer were to utilize the full 5 Mton capacity, the annual income could be substantial enough to recover the entire initial investment in the first year alone.

This basic economic assessment suggests that cold rooms can serve as a highly effective strategy to increase farm income through price management and value preservation, especially when there is a stable market. Thus, the promotion of cold storage infrastructure can play a significant role in motivating farmers and enhancing post-harvest value retention in perishable commodities like Junar.

5

Conclusion and Recommendations

5.1 Conclusion

The construction of cold rooms under the Prime Minister Agriculture Modernization Project (PMAMP) has played a significant role in reducing post-harvest losses and improving the preservation and marketability of perishable agricultural products across diverse agro-ecological zones in Nepal. The study reveals that cold rooms have contributed to better price realization for farmers, improved storage duration, and enhanced resilience of local agricultural value chains. However, several challenges persist, including underutilization in some areas, technical and operational issues, inadequate staff training, limited waste management practices, and inconsistent maintenance. The lack of reliable electricity supply, insufficient pre-cooling infrastructure, and gaps in coordination between operators and technical staff further hinder optimal performance. Despite these challenges, user feedback is generally positive, and the demand for cold storage facilities remains high, underscoring their importance for Nepal's agricultural modernization and food security.

5.2 Recommendations

1. Provide regular training and capacity-building programs for cold room operators and technical staff.
2. Invest in essential infrastructure, including pre-cooling chambers, reliable electricity (with backup options), and modern harvesting tools.
3. Promote digital monitoring systems for real-time control of temperature and humidity.
4. Strengthen coordination between cold room operators, local governments, and technical experts for better maintenance and troubleshooting.
5. Encourage community or cooperative management models for sustainable and equitable facility use.
6. Review and streamline subsidy and policy mechanisms to prevent duplication and ensure fair access.
7. Conduct feasibility studies before establishing new large-scale cold storage facilities and prioritize expansion in underserved regions.

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Annex I: List of Cold Rooms Constructed by PMAMP

क्र.स.	अनुदानग्राही समूह/सहकारी/उद्यमीको नाम	ठेगाना	सम्पर्क व्यक्ति	सम्पर्क नं	chamber/ room संख्या	chamber/ room क्षमता (MT)	निर्माण आ.व.
Koshi Province							
Okhaldhunga/ Solukhumbu							
१	क्याम्जे कृषि फर्म	सोलुदुधकुण्ड न पा ४	सोनाम लामा	९८४२८४८५६२	१	६ टन	
२	मातृभूमि युवा अर्गानिक बहुउदेश्यीय कृषि फर्म	सोलुदुधकुण्ड न पा ९	प्रवेश मगर	९८६३९६६४४६	१	६ टन	
३	गिता बहुउदेश्यीय कृषि फर्म	नेचासल्यान गा पा ३	यशोधा भण्डारी	९८२५७४३३६०	१	६ टन	
४	शेर्पा एग्रो फर्म	सोलुदुधकुण्ड न पा २	सुम्बा शेर्पा	९८४२०११८९७	१	६ टन	
५	छत्र बहुउदेश्यीय कृषि फर्म	नेचासल्यान गा पा २	कुविरधन नेवार	९८६२६३००५२	१	६ टन	
६	दुधकुण्ड दुध उत्पादन उद्योग	सोलुदुधकुण्ड न पा ४	फिन्जो लामा	९८६२८४८९६४	१	६ टन	
७	हिमालि कृषि तथा रेन्भो ट्राउट माछा फर्म	सोलुदुधकुण्ड न पा १	पासाङ गेल्जेन शेर्पा	९८६९६९२२९५	१	५-७ टन	
८	अर्गानिक बउ कृषि फर्म	नेचासल्यान गा पा १	विष्णुकुमार राई	९८४२११९३७०	१	५-७ टन	
९	अरुण कृषि फर्म	सोलुदुधकुण्ड न पा ११	गोपाल कार्की	९८४२८१९९३८	१	५-७ टन	
१०	कृषि बन तथा पशुपंक्षि केन्द्र	थुलुङदुधकोशि गा पा ८	केशव कुमार राई	९८६३८६५९१७	१	५-७ टन	
११	गौरिशंकर कृषि तथा पशु फर्म	सोलुदुधकुण्ड न पा ७	दुर्गा कुमारी श्रेष्ठ	९८६२९५९९९९	१	५-७ टन	
१२	गोराखानि किवि फर्म	सोलुदुधकुण्ड न पा ९	पेमा लमु शेर्पा	९८४२८४८६९५	१	५-७ टन	
Illam							
१	माइपोखरी हर्बल अर्गानिक एग्रिकल्चर प्रा.लि.	सन्दकपुर-३, इलाम	देउकुमार राई	९८४२७९८७८९	१	८ टन	२०८०/८१
२	ओझा किवि फर्म	इलाम-४, इलाम	महानन्द ओझा	९८४२७९८७८९	१	८ टन	२०८०/८१
३	उज्यालो कृषि फर्म	सन्दकपुर-३, इलाम	रुद्रप्रसाद खतिवडा	९८४४६४९५९१	१	८ टन	२०७९/८०
४	विष्ट किबी फर्म	इलाम- १. इलाम	गंगा बहादुर विष्ट	९८४१४४०७०९	१	८ टन	२०७८/79

क.स.	अनुदानग्राही समूह/सहकारी/उद्यमीको नाम	ठेगाना	सम्पर्क व्यक्ति	सम्पर्क नं	chamber/ room संख्या	chamber/ room क्षमता (MT)	निर्माण आ.व.
५	सन्दकपुर गाउँपालिका	सन्दकपुर-1, इलाम	सन्दकपुर गाउँपालिका	९८५२६८०६१०	१	१० टन	२०७८/79
Morang							
१	तरकारी जोन संचालन समन्वय समिति	कटहरी तरकारी तथा फलफूल थोक बजार केन्द्र	देवराज चौधरी	९८५२०२९४२७	१	१५ टन	२०८०/८१
			सिव्नाथ सिंह	९८०४३०८८६७		३ वटा च्याम्बर	
Madhes Province							
Siraha/Saptari							
१	दुर्गालक्ष्मी गाई भैसी फर्म	कंचनरुप.-१, ससरी	दुर्गानन्द यादव	९८६३९०४६३२	१		
२	ससरी महिला पशु फर्म	कंचनरुप.-३, ससरी	सरिता देवी यादव	९८०७७५८४०९	१		
३	माँ राजदेवी कृषि फर्म	कंचनरुप.-३, ससरी	निरज चौधरी	९८१५७७७१६५	२		
Dhanusha/Mahottari							
१	विवेक कृषि तथा पशुपालन फर्म	गौशाला न.पा.-३, महोत्तरी	फेकन महतो	९८२५८०९९९	१	७.४३	२०८०/८१
Sarlahi/Rautahat							
१	फतेपुर कृषक समूह	कटहरिया -६, फतेपुर		९८०८५८७४८३	१	१० टन	
२	नरसिंम्हा कृषि सहकारी संस्था	समनपुर न.पा.- २		९८६३३६९५८५	१	१० टन	
३	ग्रामिण कृषि विकास प्रा लि	गरुडा न.पा.- ५		९८४५३९३१५२	१	१० टन	
४	फतेपुर कृषक समूह	गरुडा न.पा.- ६		९८४७७८५१८६	1	१० टन	
Bagmati Province							
Sindhuli							
१	लाङ्गाली जुनार उधोग	गोलन्जोर-४, तीनकन्या	सन्त बहादुर सिंजाली	९८४४०८६७९६	१	६	२०७९/८०

क्र.स.	अनुदानग्राही समूह/सहकारी/उद्यमीको नाम	ठेगाना	सम्पर्क व्यक्ति	सम्पर्क नं	chamber/ room संख्या	chamber/ room क्षमता (MT)	निर्माण आ.व.
२	उपकर जुनार उत्पादन कृषि सहकारी सस्था लि.	गोलन्जोर-४, तीनकन्या	सुरेन्द्र ठकुरी	९८४४१५६५५२	१	६	२०७९/८०
३	कोपिला जुनार उत्पादन कृषि सहकारी सस्था लि.	गोलन्जोर-४, तीनकन्या	दुर्गा बहादुर पुर्वछाने	९८६३९३७६८३	१	६	२०७९/८०
४	मनिता एण्ड ममता जुनार कृषि फर्म	गोलन्जोर-४, तीनकन्या	लोक बहादुर आले	९८४४१४७०२२	१	६	२०७९/८०
५	श्रृजनशील जुनार उत्पादन कृषि फर्म उद्योग	गोलन्जोर-५, चिसापानी	योगेन्द्र थापा	९८६५१८५६६३	१	६	२०७९/८०
६	ठकुरी पशुपन्छी कृषि तथा फलफूल फर्म	गोलन्जोर-४, तीनकन्या	निर व. ठकुरी	९७४६५६५६००	१	६	२०८०/८१
७	श्री उत्तम पशुपन्छी तथा फलफूल फर्म	गोलन्जोर-४, तीनकन्या	इन्द्र व. पुर्वछाने मगर	९८४४३२७२६२	१	६	२०८०/८१
८	लांघाली पशुपन्छी पालन तथा कृषि फर्म	गोलन्जोर-५, खनियाँखर्क	दिल कुमारी थापा मगर	९८१६८३९५९९	१	६	२०८०/८१
९	श्री वाघभैरव पशुपन्छी तथा कृषि फर्म	गोलन्जोर-५, खनियाँखर्क	हरिबाबु गजुरेल	९८०११४५१५९	१	६	२०८०/८१
१०	हायु अग्रो फर्म	गोलन्जोर-६, नाकाजोली	नविन्द्र ब. हायु	९८४९१४५८८३	१	६	२०८०/८१
११	गैराटोल जुनार उत्पादन कृषि फर्म	गोलन्जोर-६, नाकाजोली	दिल ब. मगर	९८४११२७०४७	१	६	२०८०/८१
१२	बि.कु. जुनार तथा नर्सरी	गोलन्जोर-६, नाकाजोली	विर ब. मगर	९८४४१९७४९८	१	६	२०८०/८१
१३	पि.क्यू जुनार तथा तरकारी फर्म	गोलन्जोर-४, तीनकन्या	भोजराज गुरुङ	९८४४०४२४९६	१	६	२०८०/८१
Gandaki Province							
Kaski							
१	बराल कृषि फर्म	पोखरा -२2	ओम प्रकाश बराल	९८५६५२५५६६	२	४ टन	
२	मान्द्रेढुङ्गा बहुउद्देश्यीय सहकारी संस्था लि	पोखरा -१४, विशाल मार्ग	राधाकृष्ण पौडेल	९८४६०४८८०५	१	५-७ टन	
३	हरिलो एग्रो ईण्डष्ट्री प्रा.लि	पोखरा -१६, दिप	प्रकाश आचार्य	९८४११९३५६२	१	५-७ टन	

क.स.	अनुदानग्राही समूह/सहकारी/उद्यमीको नाम	ठेगाना	सम्पर्क व्यक्ति	सम्पर्क नं	chamber/ room संख्या	chamber/ room क्षमता (MT)	निर्माण आ.व.
४	एभरेष्ट पशुपालन तथा कृषि फर्म	पोखरा -२९, नौबिसे	दिपक प्रसाद आचार्य	९८४७६३४५५४	१	५-७ टन	
५	मर्दी एग्रो फर्म एण्ड रिसर्च सेन्टर	माछापुच्छ्रे-०६, भेडावारी	विष्णु प्रसाद भुसाल	९८४६९१४९००	१	५-७ टन	
६	सर्वगुण फुड्स एण्ड किचन प्रा.लि	पोखरा -२६, बुढीबजार	उषा गिरी पौडेल	९८४१५५०२४०२	१	७ टन	
Mustang							
१	धमाङ्ग कृषक समूह	घरपझोङ -02, मार्फा	दिपक लालचन	९८५७६५००४०	१	२० टन	
२	हिमालय एग्रो फर्म	बारागुङ गा.पा. ०४, पाण्डाखोला	कुन्साङ गुरुङ्ग	९८४१३२१६२८	२	१० टन	
३	बुद्ध एग्रो फर्म	माफ घरपझोंद ०२, मार्फा	विश्व लालचन	९८४६०५५१३३	२	१० टन	
४	न्यू अन्नपूर्ण कृषि तथा पशु मल्टि एग्रो फर्म	अन्नपूर्ण गा. पा., नारच्याङ	प्रेम प्रसाद गुरुङ	९८४६४४२०५३	२	१० टन	
५	जि. आर. अर्गानिक एग्रो स्याउ फर्म	बारागुङ गा.पा.-०२, खिंगा	रमेश गुरुङ	९८५७६५०३५७	२	१० टन	
६	हाइल्याण्ड एग्रो फर्म	घरपझोंङ-०२, मार्फा	राजु लालचन	९८५७६५०२९०	२	१० टन	
७	एमन्सी सुन्तला उत्पादन कृषि फर्म	बेनी न.पा.-९, घतान	खिमकुमारी गिरी	९८५७६२७६२८	१	५ टन	
८	रकाल इन्टरप्रेजेज प्रा लि	बे.न.पा. १०, म्याग्दी	भरत रकाल	९८५७६४०६६१	१	५ टन	
९	आयुष कृषि तथा पशुपन्छी पालन फर्म	घरपझोंङ-०२, मार्फा	आईत ज्वारचन	९८५६०२०१४५	२	१० टन	
१०	स्याङफाला सामुदायिक कृषि सहकारी संस्था लि	घरपझोंङ-०२, मार्फा	सुरेन्द्र थकाली	९८५७६५००३५	१	५ टन	
Nawalparasi East							
१	नवलपुर वायो कृषि फर्म	कावासोती -१७, ढोकी	बेनीराम महतो	९८६३३७१७५१	१	१६ टन	

क्र.स.	अनुदानग्राही समूह/सहकारी/उद्यमीको नाम	ठेगाना	सम्पर्क व्यक्ति	सम्पर्क नं	chamber/ room संख्या	chamber/ room क्षमता (MT)	निर्माण आ.व.
२	टीकाराम टुल्की कृषि फर्म	गौडाकोट -११, हर्कपुर	गुप्त प्रसाद रेग्मी	९८५५०५९१४७	१	१० टन	
Lumbini Province							
Kapilbastu							
१	महन्त कृषि फर्म	बुद्धभुमी - १०	महन्त केवट	९८०६९५५२००	१	१२ टन	
२	जय लक्ष्मी ताजा तरकारी कृषक समूह	कपिलवस्तु ०५	ओम विलास बरई	९८०७४०६६८१	१		
३	बुद्धभुमी कृषि फर्म	बुद्धभुमी - १०	कृष्ण मोहन केवट	९८१६४३०६१८	१	५ टन	
Rupandehi							
१	श्री जल देवी मत्स्य उत्पादक सहकारी संस्था लि	सियारी गा.पा.- ५, वनघुसारी	थमन बहादुर पौडेल	९८४७२८०८७३	३	५ टन	
Sudur Paschim Province							
Bajhang							
१	श्री खागडा कृषक समूह	जयपृथ्वी- ७, सुवेडा बझाङ्ग	दिपकराज जोशी	९८५८४८५६०६	१	५ टन	
२	श्री सिदार्थ फलफूल कृषक समूह	सुर्मा गा पा १	रंगी बोहरा	९८६६४२४९४४	१	५ टन	

Annex II: Survey Questionnaire/Checklist

Date(मिति):…………………………

General Information (सामान्य जानकारी)

1. **Beneficiary Information (Personal/ Farmer Group/ Co-operatives) लाभग्राही जानकारी (व्यक्तिगत/किसान समूह/सहकारी)**
   - Name नाम::…………………………..
   - Location (Local level,District,Province) स्थान (स्थानीय तह, जिल्ला, प्रदेश):………………………
   - Co-ordinate:……………………………………………..
   - Contact Person सम्पर्क व्यक्ति:…………………………………………………
   - Contact Information (Phone, Email) सम्पर्क जानकारी (फोन, इमेल):………………

Cold Room Details कोल्ड रूम विवरण

1. **Cold-room Size and Capacity (कोल्ड रूमको आकार र क्षमता)**
   - Total storage capacity कुल भण्डारण क्षमता:………………………
   - No. of Chamber चेम्बरको संख्या:………………………
   - Types of products stored भण्डारण गरिएका उत्पादनका प्रकार:………………………………………
   - Shelf life of stored goods भण्डार गरिएको उत्पादनको आयु……….................................……….
   - Current utilization rate (%)हालको उपयोग दर (%): ……………………………….
   - Temperature range maintained तापक्रम दायरा:…………………………

Operational Details (सञ्चालन विवरण)

1. **Operational Hours (सञ्चालन घण्टा)**
   - Average operational hours per day दैनिक औसत सञ्चालन घण्टा:…………………………
   - How frequently does the cold room require maintenance? - [ ] Monthly - [ ] Quarterly - [ ] Annually - [ ] Rarely कोल्ड रूमको मर्मत आवश्यक पर्ने समय - [ ] मासिक - [ ] त्रैमासिक - [ ] वार्षिक - [ ] कम

2. **Energy Consumption (ऊर्जा खपत)**

- Average daily energy consumption दैनिक औसत ऊर्जा खपत (kWh):…………………..
- Peak energy consumption उच्चतम ऊर्जा खपत (kWh):…………………………………
- Primary energy source मुख्य ऊर्जा स्रोत (जस्तै, ग्रिड, सोलार, जेनरेटर) (e.g., grid, solar, generators): …..

3. **Monitoring Systems (अनुगमन प्रणाली)**

- Types of monitoring systems in place प्रयोगमा रहेका अनुगमन प्रणालीका प्रकार (जस्तै, तापक्रम, आर्द्रता) (e.g., temperature, humidity):……………..
- Presence of alarm systems for deviations चेतावनी प्रणालीको उपस्थिति (Yes/No):……………

4. **Transportation (यातायात)**

- Transportation methods used प्रयोग गरिएका यातायातका विधि (जस्तै, रेफ्रिजेरेटेड ट्रकहरू) (e.g., refrigerated trucks):
  For Store……………………….For Delivery………

Economic Details (आर्थिक विवरण)

1. **Cost of Operation (सञ्चालन खर्च)**

- Initial setup costs आरम्भिक स्थापना खर्च:…
- Cold Roomकोल्ड रुम :
- Shed सेड…………………
- Operating Months सञ्चालन महिना

B	J	A	S	B	A	K	M	P	M	F	C

- Average monthly operating costs मासिक औसत सञ्चालन खर्च::…………………………….
- Average monthly maintenance costs मासिक औसत मर्मत खर्च:……………………………………..
- Average monthly energy costs मासिक औसत ऊर्जा खर्च:…………………………………………

2. Revenue and Profitability (आम्दानी र लाभदायकता)

- Monthly revenue generated मासिक आम्दानी:……………………………………..
- Monthly profit margins मासिक लाभ मार्जिन:……………………………………..

3. Funding and Subsidies (वित्तीय सहयोग र अनुदान)

Constructed Year निर्माण वर्ष …………………………

- Any government subsidies or incentives received (Yes/No) प्राप्त गरिएको कुनै सरकारी अनुदान वा प्रोत्साहन (हो/होइन):……………………………………………........………
- User's investment details प्रयोगकर्ताको लगानी विवरण:…………………..………..

Usage and Effectiveness (प्रयोग र प्रभावकारिता)

1. Quality and Safety (गुणस्तर र सुरक्षा)

- Quality of goods before and after storage भण्डारण गर्नु अघि र पछि सामानको गुणस्तर:………………………..

2. Losses and Spoilage Rates (क्षति र बिग्रने दर)

- Common Problems सामान्य समस्या …………………………
- Solution method समाधान विधि: ……………………………………….
- Manufacturer Response निर्माता प्रतिक्रिया ……………………………
- Average spoilage rate (%)औसत बिग्रने दर (%):………
- Measures taken to reduce losses क्षति घटाउन लिइएका उपायहरू:…………………

Stakeholder Feedback (सरोकारवालाको प्रतिक्रिया)

1. User Satisfaction (प्रयोगकर्ता सन्तुष्टि)

- Feedback from users of cold storage services (rate on a scale of 1-5) कोल्ड स्टोरेज सेवा प्रयोगकर्ताबाट प्रतिक्रिया (१-५ को स्केलमा) …
- Key issues and challenges faced by users प्रयोगकर्ताहरूले सामना गरेका प्रमुख समस्याहरू र चुनौतीहरू::………

2. **Staff Expertise (कर्मचारीको विशेषज्ञता)**

  - Training programs for staff (Yes/No) कर्मचारीका लागि तालिम कार्यक्रम :...............
  - Training Provider तालिम प्रदायक:..................

Environmental Impact (वातावरणीय प्रभाव)

1. **Sustainability Practices (दिगोपन अभ्यासहरू)**

  - Use of eco-friendly technologies वातावरणमैत्री प्रविधिको प्रयोग (हो/होइन): (Yes/No):.........
  - Waste management practices फोहोर व्यवस्थापन अभ्यास:.........

Market and Demand Analysis (बजार र माग विश्लेषण)

1. **Market Demand (बजार माग)**

  - Current demand for cold storage services हालको कोल्ड स्टोरेज सेवाको माग:......
  - Projected demand for the next 5 years आगामी ५ वर्षका लागि मागको प्रक्षेपण:.........

2. **Competitive Landscape .(प्रतिस्पर्धी परिदृश्य)**

  - Key competitors in the area क्षेत्रका प्रमुख प्रतिस्पर्धीहरू:...........

Future Plans and Innovations (भविष्य योजना र नवप्रवर्तन)

1. **Expansion Plans (विस्तार योजना)**

  - Plans for new cold storage facilities नयाँ कोल्ड स्टोरेज सुविधाका लागि योजना (Yes/No):......
  - Upgrades planned for existing facilities विद्यमान सुविधाहरूमा योजना गरिएका सुधारहरू (Yes/No):...

2. **Technological Innovations (प्राविधिक नवप्रवर्तन)**

  - Adoption of new technologies नयाँ प्रविधिको प्रयोग (e.g., IoT, automation) (Yes/No):......

Additional Comments (थप टिप्पणीहरू)

1. **Other Remarks or Suggestions अन्य टिप्पणी वा सुझावहरू**
  - Any additional comments or suggestions for improving the effectiveness of cold chambers and cold rooms? कोल्ड चेम्बर र कोल्ड रूमको प्रभावकारिता सुधार गर्नका लागि कुनै अन्य टिप्पणी वा सुझावहरू?

Annex III: FGD Participants List

1. Ramechhap

क्र.सं.	नाम	पद	संस्था/ठेगाना
१	लव श्री न्यौपाने	नगर प्रमुख	रामेछाप न.पा.
२	समिर कार्की	नगर प्रवक्ता	रामेछाप न.पा.
३	होम बहादुर थापा	नि.प्र.प्र.अ.	रामेछाप न.पा
४	नारायण सुवेदी	शा.अ.	रामेछाप न.पा
५	राजेश तामाङ	वडा अध्यक्ष	रा.न.पा.-६
६	थीरलाल गैह्रे	नि.ब.कृ.अ.	प.का.ए.,रामेछाप
७	विनिषा श्रेष्ठ	कृषि अधिकृत	प.का.ए.,रामेछाप
८	विज्ञान आचार्य	कृषि इन्जिनियर	प.का.ए.,रामेछाप
९	श्याम बहादुर तामाङ	ना.प्रा.स.	प.का.ए.,रामेछाप
१०	भवानी बस्नेत	ना.प्रा.स.	प.का.ए.,रामेछाप
११	बल बहादुर थापामगर	ना.प्रा.स.	प.का.ए.,रामेछाप
१२	ढाल विक्रम कार्की	जु.जो.स.स.स.सदस्य	रामेछाप
१३	हरि बहादुर तामाङ	प्रगतिशिल कृषि उत्पादन फर्म	रामेछाप
१४	पदम बहादुर लामा	जु.जो.स.स.स.उपसंयोजक	रामेछाप
१५	गुञ्ज बहादुर कार्की	जु.जो.स.स.स.संयोजक	रामेछाप
१६	रामकुमार कार्की	जनसहयोगी कृषि समुह	रामेछाप
१७	लोक बहादुर श्रेष्ठ	एग्रो फरेष्ट प्रा.लि.	रामेछाप
१८	शेर बहादुर तामाङ	कामना नर्सरी फर्म	रामेछाप
१९	हेम बहादुर तामाङ	श्री रसिलो जुनार सहकारी कोषाध्यक्ष	रामेछाप
२०	प्रेम बहादुर तामाङ	श्री रसिलो जुनार सहकारी सदस्य	रामेछाप
२१	पर्शुराम तामाङ	समृद्धि साना किसान कृषि सहकारी	रामेछाप
२२	धन बहादुर घिसिङ	प्रेरणा कृषि नर्सरी फर्म	रामेछाप
२३	कुलेन्द्र तामाङ	श्री रसिलो जुनार सहकारी सदस्य	रामेछाप
२४	बम बहादुर तामाङ	कृषक जागरण कृषि सहकारी सदस्य	रामेछाप
२५	निम बहादुर श्रेष्ठ	श्री रक्त माला कृषक समुह	रामेछाप
२६	शुक्र मगर	श्री पशुपति कृषि सहकारी सचिव	रामेछाप
२७	बाबुराम पुलामी मगर	श्री पशुपति कृषि सहकारी कोषाध्यक्ष	रामेछाप

क्र.सं.	नाम	पद	संस्था/ठेगाना
२८	खिल बहादुर कार्की	कृषि महाकाली कृषि सहकारी संस्था लि.	रामेछाप
२९	कमिता दास श्रेष्ठ	सचिवालय, नगरप्रमुखज्यू	रामेछाप
३०	डा.इ.जीत बहादुर चन्द	वरिष्ठ कृषि इन्जिनियर	प.व्य.ए., ललितपुर
३१	समिर श्रेष्ठ	कृषि इन्जिनियर	प.व्य.ए., ललितपुर

2. Sindhuli

क्र.सं.	नाम	पद	ठेगाना
१	डा.इ.जीत बहादुर चन्द	वरिष्ठ कृषि इन्जिनियर	प.व्य.ए., ललितपुर
२	याम कुमार श्रेष्ठ	वरिष्ठ कृषि अधिकृत	प.का.ए., सिन्धुली
३	विनय बावु कोइराला	कृषि अधिकृत	प.का.ए., सिन्धुली
४	गोविन्द बहादुर लुङ्गेली	कृषि अधिकृत	प.का.ए., सिन्धुली
५	सरोज दाहाल	कृषि शाखा प्रमुख	गोलन्जोर गा.पा.
६	हिरा बहादुर राना	कृषक	गोलनजोर गा.पा.
७	दुर्ग बहादुर पुर्वछाने	कृषक	गोलनजोर गा.पा.-४, तिनकन्या
८	दिपक कुमार थापा	कृषक	गोलन्जोर -५, नयाँखर्क
९	हरि बहादुर गजुरेल	कृषक	गोलन्जोर -५, खनियाखर्क
१०	लाल बहादुर ठाडा	कृषक	गोलन्जोर -४, तिनकन्या
११	दान बहादुर रस्तेल	कृषक	गोलन्जोर -४, तिनकन्या
१२	मोहन ठकुरी	कृषक	गोलन्जोर -४, तिनकन्या
१३	भोजराज गुरुङ	कृषक	गोलन्जोर -४, तिनकन्या
१४	यज्ञन्द्र बहादुर थापा	कृषक	गोलन्जोर -५, चिसापानी
१५	बेग बहादुर गौदासे	कृषक	गोलन्जोर -४, तिनकन्या
१६	धन बहादुर आले	कृषक	गोलन्जोर -४, तिनकन्या
१७	तेज बहादुर मगर	कृषक	गोलन्जोर -५, खनियाखर्क
१८	सुनिल रस्तेल	कृषक	गोलन्जोर -५, छविस
१९	दिल बहादुर मगर	कृषक	गोलन्जोर -६, नाकाजोली
२०	विसाल मगर	कृषक	गोलन्जोर -६, नाकाजोली
२१	सुस्मा कार्की	विद्यार्थी	प.का.ए., सिन्धुली

क्र.सं.	नाम	पद	ठेगाना
२२	आस्था काफ्ले	विद्यार्थी	प.का.ए., सिन्धुली
२३	मिश्रण ददेल	विद्यार्थी	प.का.ए., सिन्धुली
२४	सोफिया महर्जन	विद्यार्थी	प.का.ए., सिन्धुली
२५	सन्त माया बुढामगर	विद्यार्थी	प.का.ए., सिन्धुली
२६	निर बहादुर ठकुरी	कृषक	गोलन्जोर -४, तिनकन्या
२७	इन्द्र बहादुर पूर्वछाने	कृषक	गोलन्जोर -४, तिनकन्या
२८	जाहन बहादुर कार्की	कृषि प्राविधिक	प.का.ए., सिन्धुली
२९	दिलिप कार्की	सब-इन्जिनियर	प.का.ए., सिन्धुली
३0	गंगालाल गौतम	का.स.	प.का.ए., सिन्धुली
३१	भक्त बहादुर भुजेल	वडा अध्यक्ष	गोलन्जोर -४, तिनकन्या
३२	लोक बहादुर आलेमगर	कृषक	गोलन्जोर -४, तिनकन्या

3. Dolakha

क्र.सं.	नाम	पद	संस्था/ठेगाना
१	डा.इ.जीत बहादुर चन्द	वरिष्ठ कृषि इन्जिनियर	प.व्य.ए., ललितपुर
२	समिर श्रेष्ठ	कृषि इन्जिनियर	प.व्य.ए., ललितपुर
३	उषा थापा	सञ्चालक	तिलोत्तमा हिमाली फुड, दोलखा
४	सञ्जीव के.सी.	कृषि प्राविधिक	जोन प्राविधिक एकाइ, दोलखा
५	किरण बहादुर खड्का	कलङ नमुना किवी तथा कृषि सहकारी	जिरी-७, दोलखा
६	राधाकृष्ण शिवाकोटी	हिमगिरी कृषि उपज एवम् नर्सरी फर्म	मि.न.पा-१
७	रमेश बस्नेत	अनुग्रह कृषि तथा पशुपन्छी फार्म	मि.न.पा.-८
८	निमा लामा मोक्तान	कृषि तथा पशुपालन फार्म	गौरीशंकर-४
९	उर्मिला चौलागाई	कृषि प्राविधिक	जोन प्राविधिक एकाइ, दोलखा
१०	विष्णु भुजेल	समृद्ध कृषि तथा पशुपन्छी फार्म	मि.न.पा.-८
११	नबिना दाहाल	कृषि प्राविधिक	जोन प्राविधिक एकाइ, दोलखा
१२	नारायण बस्नेत	कालिञ्चोक किवी तथा पशुपन्छी फर्म	दोलखा
१३	अन्जली बुढाथोकी	इका.एफ.आर.सि.	दोलखा
१४	पुष्पा जिरेल	कृषि प्राविधिक	प.का.ए.,रामेछाप

4. Sunsari

S.N.	Name	Designation	Address
1	Dr. Jeet B Chand	Senior Agricultural Engineer	PMAMP, PMU, Khumaltar
2	Sameer Shrestha	Agricultural Engineer	PMAMP, PMU, Khumaltar
3	Dol Prasad Sharma	Agricultural Engineer	PMAMP, PIU, Chitwan
4	Lochan Poudel	Agricultural Engineer	PMAMP, PIU, Kailali
5	Bigyan Acharya	Agricultural Engineer	PMAMP, PIU, Ramechhap
6	Anil Shrestha	Agricultural Engineer	PMAMP, PIU, Okhaldhunga
7	Netra Bohara	Agricultural Engineer	PMAMP, PIU, Achham
8	Sushant Kumar Mahato	Entrepreneur	Rautahat
9	Jitendra Sahani	Entrepreneur	Rautahat
10	Manish Thakur	Agricultural Engineer	PMAMP, PIU, Kapilvastu
11	Jyoti Rai	Agricultural Engineer	PMAMP, PIU, Dang
12	Keshab Kumar Rai	Entrepreneur	Solukhumbu
13	Umesh Kumar Mahato	Agriculture Officer	Mithila Municipality, Dhanusha
14	Sonam Lama	Entrepreneur	Solukhumbu
15	Dilip Karki	Overseer	PMAMP, PIU, Sindhuli
16	Madhu Neupane	Overseer	PMAMP, PIU, Nuwakot
17	Dinesh Gole	Agricultural Engineer	PMAMP, PIU, Salyan
18	Yagandra Bahadur Thapa	Entrepreneur	Sindhuli
19	Lok Bahadur Ale Magar	Entrepreneur	Sindhuli
20	Rajesh Basnet	Entrepreneur	Dolakha
21	Hem Bahadur Tamang	Entrepreneur	Ramechhap
22	Lok Bahadur Shrestha	Entrepreneur	Ramechhap

List of Contributers

Er Dol Prasad Sharma
PMAMP-PIU, Chitwan
NEC No.469 “A”

Er Chhabi Dangi Chhetri
PMAMP-PIU, Rupandehi
NEC No. 378 “A”

Er Bigyan Acharya
PMAMP-PIU,
Ramechhap
NEC No. 443 “A”

Er Anish Shrestha
PMAMP-PIU,
Okhaldhunga
NEC No.89592 “A”

Er Manish Thakur
PMAMP-PIU, Kapilbastu
NEC No. 203 “A”

Er Sushil Budha
PMAMP-PIU, Mustang
NEC No. 500 “A”

Er Netra Bohara
PMAMP-PIU, Achham
NEC No. 468 “A”

Er Nagendra Tharu
PMAMP-PIU, Illam
NEC No. 448 “A”

Dilip Karki
PMAMP-PIU, Sindhuli